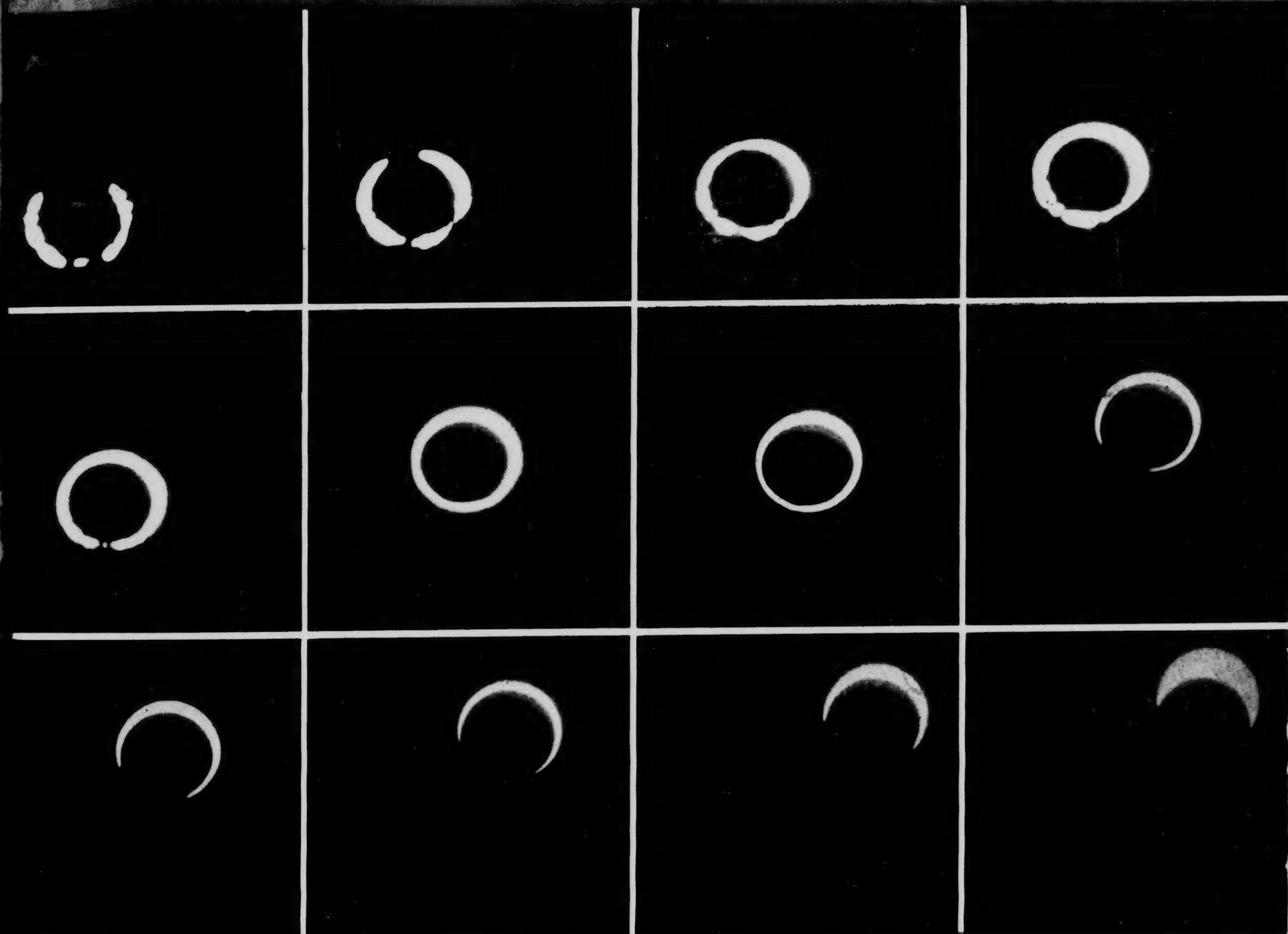
Sky and TELESCOPE



Annular eclipse

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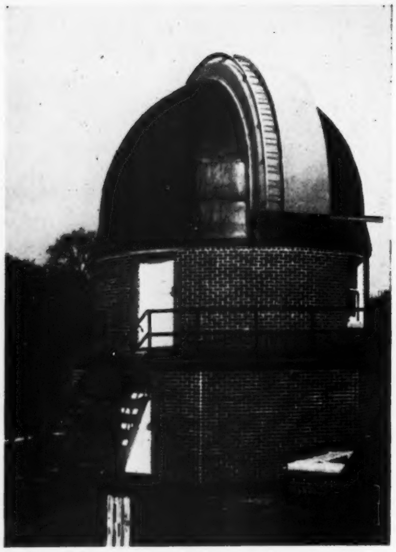

The University of Alabama Observatory.

New Alabama Observatory

Although during the 19th century astronomy was actively pursued at the University of Alabama, there followed a period of relatively minor activity as the original equipment fell into disuse. In November, 1950, however, a new observatory was dedicated, located on the fourth and fifth floors of the north wing of the new physics building. The center of the dome pictured here is approximately 60 feet above the ground level, and 285 feet above sea level. The longitude is 87° 32′ 33″ west, the latitude, 33° 12′ 33″ north, at University, Ala.

The dome, which has an inside diameter of 20 feet, is of copper-covered steel framing. It is rotated by a continuous friction cable driven by an electric motor. The concrete floor, covered with rubber tile, is supported as a cantilever and isolated mechanically from the steel frame of 8-inch I-beams on which the telescope stands. This steel frame rests on brick pilasters extending to the building foundation.

The telescope is a 10-inch refractor of 150 inches focal length, manufactured by J. W. Fecker Company of Pittsburgh. Four eyepieces in a turret give powers of 75, 150, 300, and 600 times. The two-ton equatorial mounting is equipped with slow-motion settings in right ascension and declination. There is a 3-inch f/10 finder.

Attached to the same mounting is a wide-angle survey camera containing a 3-inch f/5 Ross lens and an 8 x 10 plateholder. Other auxiliary observatory equipment includes a small portable transit instrument and a 5-inch clock-driven equatorial refractor.

THE INDEX TO VOLUME X

of Sky and Telescope is included, without charge, in this issue. It may be removed from the staples in the center of the magazine, for binding at the front or back of a complete 1950-51 volume.

Sky and TELESCOPE

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CHARLES A. FEDERER, JR., *Editor;* HELEN S. FEDERER, *Managing Editor*

In Focus

"PROBABLY the finest known example of this phenomenon" was the verdict of Dr. Heber D. Curtis in Lick Observatory **Publications XIII**, concerning the spiral galaxy NGC 4594, reproduced on this month's back cover from a new 200-inch photograph. Dr. Curtis had noted that a "remarkable, slightly curved, clear-cut dark lane runs along the entire length." He added that very slight traces of spiral whorls could be seen. One of the more spectacular of the edgewise spirals, this galaxy has become known as the Sombrero nebula, and the 200-inch picture contains details hitherto unseen with lesser telescopes.

The Sombrero is one of the intrinsically brighter members of several hundred composing the Coma-Virgo supergalaxy. Its photographic magnitude of 8.6 places it ninth among the galaxies of all types in apparent brightness. Visually, the yellow-white color characteristic of its **F5** spectral classification makes it slightly brighter. Its absolute magnitude is −17.4, equivalent roughly to the light of a billion suns. Various estimates place this object seven to eight million light-years away, and its radial velocity (recession) is 1,180 kilometers per second.

It is a spiral of type Sa, and its dimensions are 7.0 by 1.5 minutes of arc. Near the center, the obscuring band is nine seconds of arc wide. F. G. Pease, using the Mount Wilson 60-inch reflector, placed his spectrograph slit along the major axis of the galaxy to determine the rotational velocity. At two minutes of arc from the center, the spectral lines showed a relative displacement corresponding to a rotation of 330 kilometers per second. The west, or right-hand side of the galaxy is approaching the observer. In more recent measurements at Lick Observatory, Dr. N. U. Mayall has found the rotation period to be about 11 million years. (See **Sky and Telescope,** page 5, November, 1948.)

The galaxy is actually located on the Corvus-Virgo boundary at $12^h\ 37^m.3$, −11° 21′, away from the main Coma-Virgo cluster area. Although much brighter than the average Messier galaxy, it was overlooked in Messier's earlier work.

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WHOLE NUMBER 120

OCTOBER, 1951

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COVER: A series of photographs of the annular eclipse of the sun, September 1, 1951, as seen from the Smith-Reynolds airport, Winston-Salem, N. C. A 4 x 5 Speed Graphic camera was used, with 15-inch telephoto lens. Exposures ranged from 1/10 second at f/5.6 to 1/400 second at f/32, on Isopan and Dupont 428. Photographs by Carl A. Wiegold, Winston-Salem Journal. (See page 287.)

BACK COVER: The edge-on spiral galaxy NGC 4594, Messier 104, in Virgo, photographed with the 200-inch Hale telescope. West is at the top, north at the left. Mount Wilson and Palomar Observatories photo. (See In Focus.)

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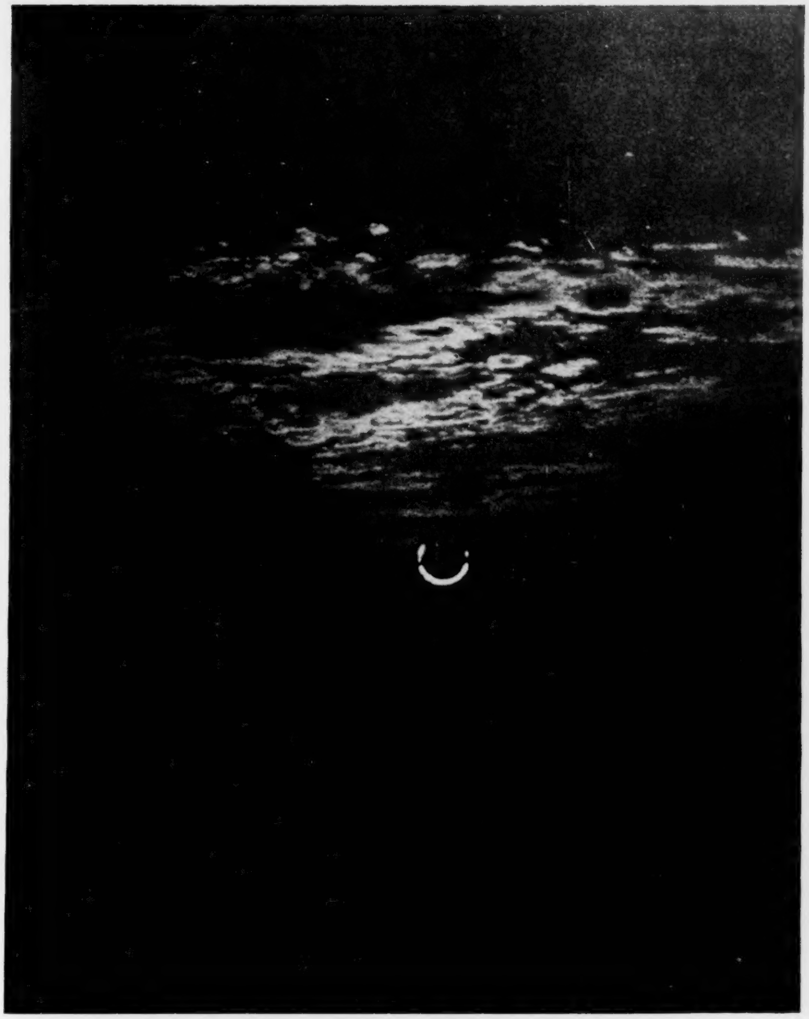


The annular phase as seen from Clarksville, Va., through ground fog and a layer of altocumulus clouds. The exposure was 1/200 second at f/16 on Dupont 428 panchromatic. Photograph by Robert E. Cox.

ECLIPSE EXPERIENCES

BY OWEN GINGERICH

OBSERVERS in the Blue Ridge Mountains of North Carolina had the ringside seats for the annular eclipse of September 1st. Threatening clouds which menaced most of the central path rolled away in time to give several thousand persons an opportunity to see a rosy annulus a few minutes after sunrise.

A hundred miles eastward the ring of light was seen in spite of scattered clouds. Some observers could catch only parts of the ring between low cumulus. At Chapel Hill, however, conventionites waited until a few minutes after the third contact before the clouds parted to reveal an 85-per-cent eclipse. At Virginia Beach and Ocean View near Norfolk, a low fog blocked the show from sunrise to over 20 minutes past the annular phase. The Chicago weather bureau noted that heavy cloud coverage also spoiled the partial phases for most Middle Westerners.

Nearly 1,500 people gathered at Elk Mountain overlook near Deep Gap, N. C., before sunrise on Saturday morning. As sunrise time approached, many wished they had stayed in bed, for a heavy bank of clouds obscured the view to the east. But a few minutes before annularity, the haze seemed to drop, giving the crowd a perfect view of the eclipse from a point almost on the center of the path.

To the west, several hundred sungazers parked on the slopes of Grandfather Mountain. Low clouds spread over the sky during twilight, obscuring the actual sunrise. For Paul Stevens, from his 3,800-foot vantage point along the Blue Ridge Parkway near the mountain, a long rift in the clouds permitted a view of the annular phase and third contact before closing out the remainder of the eclipse. "It was a glorious red that could be comfortably viewed without a filter. Observers using large Zeiss binoculars noted that the ring thickness appeared to be a smaller fraction of the solar diameter than when viewed with the unaided eye, as a result of reducing the effect of irradiation," Mr. Stevens said. Although Jupiter was easily seen, any bright stars were obscured by clouds. Some would-be observers failed entirely to see the eclipse, as thousands of automobiles were caught in traffic jams along the mountain roads and the Blue Ridge Parkway in Virginia and North Carolina.

In spite of a slight haze, about 200 observers gathered atop 6,684-foot Mt. Mitchell, highest peak in the East, saw a complete annulus. According to a report telephoned to the Astronomical League convention by Frank Hood, who is from Asheville, N. C., a reddish-orange ring was sighted. Both Jupiter and Sirius appeared. A second telephone message, from Myrtle Point, elevation 6,500 feet in Great Smoky Mountains National Park, by Mrs. Jack Huff reporting for Robert P. White, described a red ring just at sunrise. Castor and Pollux and several stars of Orion were visible there, in addition to Sirius and Jupiter.

In the vicinity of Winston-Salem and Pilot Mountain, early risers had an excellent view in spite of scattered clouds. Spectators crowded the taller buildings of Winston-Salem, and more than a thousand thronged to the Smith-Reynolds airport. From that site Winston-Salem *Journal* staff photographer Carl Wiegold made a sequence of photographs from sunrise to a point well past third contact (see front cover). With a Speed Graphic with a telephoto lens of 15-inch focal length, he used Isopan and Dupont 428 film and exposures ranging from 1/10 to 1/400 second. His elevation was 958 feet above sea level. Similar photographs were procured by Kenneth A. Shepherd, at the projected focus of a home-made 13-power camera of the Galilean type.

Observers E. A. Halbach, Milwaukee, and Lyle T. Johnson, La Plata, Md., found conditions at Pilot Mountain "nearly ideal." Although a veteran observer of eclipses, Halbach went this time "just to look." For him, opaque clouds gave a false "Baily's beads" effect. Because of the haze, the second contact was indefinite, although both third and fourth contacts were satisfactory. Over the state line into Virginia just to the north, Luc Secretan reported a perfect eclipse observation, with an annular phase lasting one minute and 27 seconds. This was at Philpott Dam,

and Mr. Secretan took several successful telephoto pictures.

Greensboro residents saw two glowing orange points of light edging over the horizon at 5:58 a.m. EST, seven minutes after sunrise. As the minutes ticked by the outlines of the crescent sun appeared. And then came the climax — a dazzling circle of orange brilliance.

J. F. Hawk, of Petrolia, Pa., paraphrased the sentiments of all the observers in the eastern part of the path: "If they could have postponed that eclipse two hours, Danville would have been perfect." Low cumulus clouds threatened his view at Danville, and broke the annular ring, but between third and fourth contacts the sky cleared. Similar conditions prevailed 40 miles east at Clarksville, where Robert E. Cox, of the Stamford Museum, made the photograph reproduced with this report. He, Sam Roth, of New York City, and Maurice Parson, of Lansing, Mich., left Chapel Hill's crystal clear sky at three o'clock in the morning to drive 65 miles nearly to the central line, where with binoculars and dark filters they could see most of the annulus in spite of the ground fog. As the eclipse became visible seven minutes before annularity, high clouds interfered with the perfection of the complete ring.

Approximately 200 amateurs, armed with 30 telescopes as well as a host of cameras, waited for the eclipse at Piney Prospect, just outside Chapel Hill. Although expecting an interesting cusp effect because of their position at the southern edge of the path, they were clouded out during the annular phase. Joseph Eichberg, Jr., of Great Neck, N. Y., said, "Although the annulus itself was not visible, I could easily tell when this phase had been reached. A few minutes before central eclipse, it began to grow perceptibly darker. Soon, as the climax came, the light from behind the clouds ceased abruptly, and remained that way for perhaps 45 seconds. Then the whole process repeated in reverse. Ten minutes later the sun emerged approximately 85 per cent covered, making a beautiful sight."

Two planes left the Chapel Hill airport shortly before the annular phase. One, carrying Jeremy Knowles, of Marblehead, Mass., and John Reed, Columbia, Mo., circled Chapel Hill. The second, with Richard Davis, from Raleigh, N. C., and Mabel Sterns, of Washington, D. C., flew northward toward the central line. From the first plane the eclipse was first seen about 10 minutes before annularity, and observations were only slightly hindered by small clouds; the annulus was seen distinctly for the seeming instant it remained. Miss Sterns reported that a few clouds cut the ring temporarily during the annular phase, and also obscured the third contact. Both planes flew at about 5,000 feet altitude.

Three junior astronomers drove down from Washington, D. C., to Ocean View, bringing the refractor pictured here and a 10-inch photographic reflector. They are John Kusner, East Falls Church, Va., Craig R. Harrison, Greenwich, Conn., and Howard W. Silsby, Arlington, Va. Photograph by Owen Gingerich.

Clifford Albaugh, from New Rumley, Ohio, observing at Lawrenceville, and Armand Spitz, of Philadelphia, observing from Emporia, Va., both announced that they had been fogged out completely during the annular phase. Although an obvious darkening of the landscape was noticed by observers on Ocean View beach near Norfolk, the writer found this to be the worst possible location along the central path. About 20 minutes elapsed after mid-eclipse before the sun could be seen through the fog.

At Norfolk airport, Peter Leavens, of Oceanside, N. Y., met "total failure" as the coastal fog prevented even a take-off in an airplane. Dr. J. S. Zabner writes: "Being one of the few from the Norfolk Astronomical Society that could not leave for Chapel Hill on Friday, I made plans with great anticipation to observe the eclipse from Virginia Beach. I arose at 4:30 a.m. and arrived there at 5:36. There was quite a crowd of early birds on the boardwalk and a large group of photographers ready for the great event." But heavy clouds spoiled the annular phase and permitted only fleeting or poor views of the later phases. Dr. Zabner concludes, "At least we saw something. It could have been worse."

From Bermuda, John Wolbach, vacationing from Harvard Observatory, reported that with the co-operation of the kitchen help of the Princess Hotel he shared smoked pieces of glass to view the partial eclipse. The sky was mostly clear, with cumulus clouds not interfering seriously with his observations.

In New York City 50 amateurs crowded the top of the Empire State Building to photograph an 87-per-cent partial eclipse, in spite of a haze which blocked the first part of the phenomenon. Robert Coles, chairman of the Hayden Planetarium, flew at 12,000 feet to a point several hundred miles southeast of New York. He described his view as "amazing" and "glorious." Pittsburgh, Boston, Chicago, and Louisville reported that an overcast prevented observation of the partial eclipse.

The foregoing material has been compiled chiefly from reports to the eclipse convention of the Astronomical League at Chapel Hill, also from newspaper accounts and private correspondence.

ECLIPSE SAROS SERIES

The annular eclipse of September 1, 1951, was the 40th in its saros cycle, according to the charts and tables of Oppolzer's **Canon der Finsternisse**. The first of the series, a small partial eclipse, occurred on June 22, 1248. Because this series occurs at the descending node of the moon, the first eclipse was visible at the south pole, and successive eclipses each appeared about 180 miles farther north. The umbral shadow of the moon in this series first struck the earth, still in the polar regions, on October 9, 1428.

At the 21st eclipse of this sequence, on February 4, 1609, the ends of the central path appeared as an annular eclipse, although the middle part was total. This phenomenon repeated 13 times, until July 8, 1861, when the eclipse was annular over the entire path. In the meantime, by 1825 the center of the eclipse path had reached the equator for the 33rd eclipse of the series.

Because Oppolzer's work closes with the year 2162, no eclipses after the 51st in the series were investigated. Presumably after a few more annular eclipses, about a dozen partial eclipses will conclude the series at the north pole. Since each series contains about 71 eclipses and lasts 1,200 years, the final small partial should occur in the 25th century. The shadow of the moon will then pass through space, invisible, high above the north pole, for about 6,000 years. The slow westward movement of the moon in each saros period will then bring it near the ascending node, and a new group of southward traveling eclipses will begin. O. G.

THE LEUSCHNER OBSERVATORY

By action of the board of regents of the University of California and in conformance with a recommendation of the astronomy department at Berkeley, the Students' Observatory on the Berkeley campus has been renamed the Leuschner Observatory, in recognition of Professor A. O. Leuschner's services to astronomy and the university.

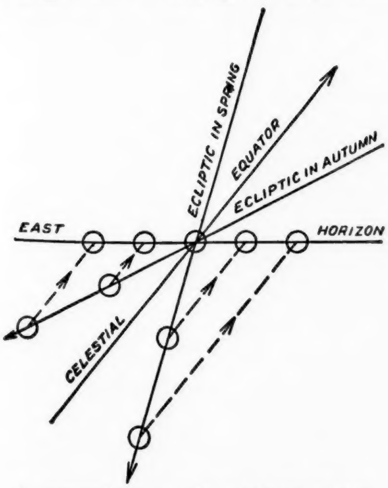
TERMINOLOGY TALKS—J. Hugh Pruett

THE LATE Dr. Clyde Fisher, scientist and authority on the lore of the American Indian, tells us in his excellent book, *The Moon,* that many tribes named lunar months for circumstances characteristic of the time of year under consideration. But the names varied with the tribes. He mentions the following as examples, starting with January: Snow moon, Hunger moon, Awakening moon, Grass moon, Planting moon, Rose moon, for the first half of the year. For September there was the Harvest moon, the Falling Leaf moon for October, and the Long-night moon for December. Other tribes had other names. We shall consider here only two of these "moons."

Harvest Moon and Hunter's Moon

Someone has written, "There is magic in the autumn when the harvest moon hangs high." Another has said, "Harvest moon is early autumn's gift to lovers and laborers." At any rate, September and October bring us that delightful season when the evenings are glorious with an abundance of mellow light. For several nights in succession moonrise occurs only a short time later any night than on the preceding one, thus keeping the early evening well lighted for more nights than usual.

Throughout the year, moonrise occurs on an average 51 minutes later each succeeding day. This retardation is due to the moon's eastward revolution around the earth once in about a month, but its actual amount is affected greatly by the latitude of the observer and the orientation of the moon's path to the horizon. The full moon around the time of the autumnal equinox is on that part of its path which, at the time of rising, makes a very gentle slope with the eastern horizon. This path inclines strongly toward the north as it goes downward, thus lessening the moon's daily movement farther below the horizon, although it travels its customary number of degrees along its path. The point of rising is thus farther northward each succeeding evening. The farther north from the equator the observer is located, the more pronounced are the effects of the harvest and hunter's moons, as shown by the table.



A comparison of the position of the moon's orbit and the eastern horizon in the spring and fall. From "Astronomy" (third edition), by R. H. Baker, published by D. Van Nostrand Co.

At latitude 45° north, the retardation this year between September 15th and 16th was only 18 minutes, and it was only a little more than this for a few days before and after these dates. At latitude 58°, the northern parts of Scotland, Alberta, and Quebec, it was only two minutes between the dates given above. At latitude 45° north, between October 12th and 13th, a retardation of only 18 minutes will occur, and at 58° north this will be only two minutes. At 60° north, the effect is even more amazing, for there the rising time gets earlier for a few days, and effectively does not change at all from the 9th to the 16th of October!

MOONRISE AT GREENWICH

Date			*Latitude North*		
Sept.	35°	45°	54°	58°	60°
9	14:05	14:50	15:55	16:45	17:26
10	15:04	15:46	16:45	17:28	17:59
11	15:54	16:29	17:16	17:48	18:08
12	16:35	17:01	17:36	17:58	18:11
13	17:09	17:27	17:50	18:03	18:12
14	17:39	17:49	18:00	18:07	18:11
15	18:07	18:08	18:09	18:10	18:10
16	18:33	18:26	18:17	18:12	18:09
17	19:01	18:46	18:27	18:15	18:08
18	19:30	19:07	18:38	18:19	18:09
19	20:02	19:32	18:52	18:26	18:10
20	20:39	20:03	19:12	18:38	18:14
21	21:22	20:41	19:42	18:58	18:26
22	22:11	21:28	20:24	19:36	18:57
Oct.	35°	45°	54°	58°	60°
7	13:00	13:42	14:43	15:29	16:03
8	13:51	14:28	15:19	15:54	16:17
9	14:34	15:03	15:42	16:07	16:22
10	15:09	15:30	15:57	16:13	16:23
11	15:40	15:52	16:08	16:18	16:23
12	16:08	16:12	16:17	16:21	16:22
13	16:34	16:30	16:26	16:23	16:22
14	17:00	16:49	16:35	16:26	16:21
15	17:29	17:09	16:45	16:30	16:21
16	18:00	17:33	16:58	16:35	16:22
17	18:35	18:01	17:15	16:45	16:25
18	19:16	18:37	17:41	17:02	16:34
19	20:03	19:20	18:18	17:32	16:56
20	20:55	20:13	19:10	18:23	17:46

This information, from the 1951 *American Ephemeris and Nautical Almanac*, gives the local civil time of moonrise (moon's upper limb) for the meridian of Greenwich. For longitudes west of Greenwich 12 hours or less, one may interpolate by multiplying the difference in moonrise times above (for any date and the next succeeding date) by the 24th part of the longitude in hours and decimals of an hour. Add this product to the moonrise time on the first date and then correct this local time to standard time, if desired.

It is important to note that this effect occurs also at other seasons of the year, but then the moon is not near the full phase. For instance, the small retardations occurred in March at the time of new moon, but around full moon at that time the delay in the moon's rising was as much as one hour, 23 minutes.

Harvest moon is usually defined as the full moon that occurs nearest the time of the autumnal equinox. The "season" of harvest moon may be said to be the period of a week or 10 days near the middle of which this full moon occurs, this year on September 15th. But this rule can sometimes place harvest moon in early October, and some students contend that the last full moon before the equinox should be designated as harvest moon; the first one after this date, hunter's moon. The harvest moon might then come in late August. In any event, the next full moon after the harvest moon is generally known as the hunter's moon.

The spell of the harvest moon has long been extolled in song and story. The term is said to have originated in England and Scotland where the gathering of crops occurred in September. Then all were anxious to work long hours although the days were becoming shorter; thus, the unusual number of moonlight evenings around full moon aided greatly the labor in the fields.

MERCURY
A Study in Singularity

In eighty-eight days Mercury
Circles the sun,
And astronomers formerly had
Their quota of fun
Watching the little rascal's
Elliptical frisk,
And predicting his transits across
The solar disk.

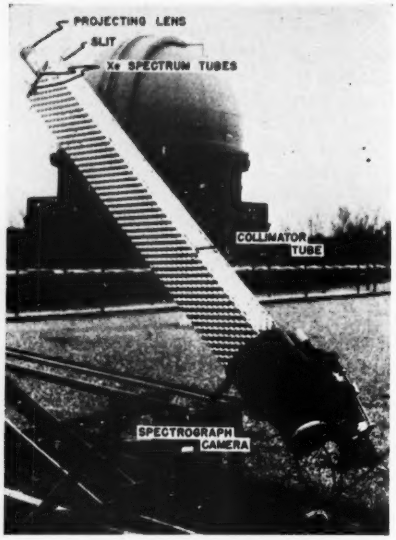
But the more they measured the more
They were forced to confess
That the smallest of planets was making
A terrible mess:
The change in his orbital nodes
Was exposing flaws
In heretofore incontrovertible
Newtonian laws.

And as varied as hues on the surface
Of a trotting chameleon
Were attempts to explain the advance
Of his perihelion.
By heroic effort the faulty
Rules were preserved,
Until Einstein got the idea
That space must be curved.

And this explained to everyone's
Satisfaction,
Though no one's understanding,
The erratic action.
Defying axioms, Mercury,
By a brash disparity,
Revealed a rather subtle
Regularity. S. C. Florman

Hydrogen Showers -- II

By Otto Struve, *Berkeley Astronomical Department University of California*



The night-sky and auroral spectrograph, built by A. B. Meinel. Yerkes Observatory photograph.

SUPPOSE a stream of ionized atoms and free electrons is ejected from the sun, remaining on the average almost electrically neutral. Such a neutral stream, when it approaches the earth, is not acted upon by the magnetic field and presumably may penetrate into the atmosphere on the daytime side, producing strange ionospheric effects, in the nature of radio fadeouts and other phenomena.

An interesting method to detect these streams is to observe the change in radio reception following an eclipse of the sun. The bundle of corpuscular particles from the sun comes from a small area, and is emitted into a solid angle of about 10 degrees. If such a bundle happens to be on its way during a solar eclipse, it may be shut off by the moon, thus forming a cylinder of obscuration which reaches the earth with a delay caused by the finite speed of the particles. There are reports that, for example, on July 9, 1945, J. L. Alpert and B. N. Gorojankin, near Moscow, observed such a corpuscular eclipse and found from the time lag a velocity of 400 to 600 kilometers per second for the particles.

But these head-on particles do not give rise to the auroras at night. Somehow, charged particles must come into the vicinity of the earth in such a manner that they can be deflected by the magnetic field. Theoretically this is possible, according to Chapman and Ferraro, because the atoms must become ionized while they are in flight. The separate electrons and atomic nuclei or ions acquire different thermal motions and are then acted upon differently by the earth's magnetic field.

On the other hand, Alfvén attributes to rapidly changing magnetic fields of disturbed areas on the sun the ability to separate very slightly the positive ions from the electrons. Then, in the vicinity of the earth, the latter's field carves a great cavity in the stream, deflecting the electrons to one side and the ions to the other. Either group could produce auroral effects, and the question is whether we can tell which is which.

An attempt to answer this question theoretically was made by P. Swings at the 1947 symposium celebrating the 50th anniversary of the Yerkes Observatory. He concluded that electrons traveling at 800 to 1,600 kilometers a second would have small energies and would be stopped at elevations far above the level of 100 to 200 kilometers where the auroras are usually located. He said: "The conclusion seems inescapable that the exciting particles are atoms, the only kind compatible with the auroral spectrum and the solar abundances being hydrogen."

The presence of hydrogen lines in the spectra of some, but not all, auroras was discovered by Vegard in 1933, and confirmed by Stoermer. In his most recent observations, Vegard noticed that the Balmer lines are often broad, and sometimes displaced toward the violet. Similar results were also obtained by C. W. Gartlein at Cornell University, who has observed the hydrogen lines on about 75 nights since 1942.

A sketch by S. Chapman to show the hollow carved in a stream of ionized particles advancing past the earth from the sun. Because of the polarizing influence of the earth's magnetic field, the surface of the hollow is charged, and the surface charges tend to bridge the gap, although they can do so only at a certain distance from the earth, owing to their deflection by the earth's field. Chapman tentatively suggests that this passage across the gap is the beginning of the main phase of a magnetic storm.

But the most conclusive results came during the nights of August 18 and 19, 1950, when an exceptionally brilliant aurora borealis was observed over most of the northern United States. This was the occasion for which A. B. Meinel had been waiting. A powerful grating spectrograph (pictured here) of his own construction had been mounted on the flat roof of the main observatory building at Yerkes.

In this instrument, a small projection lens forms upon the slit an image of an area of the sky. The collimator is 96 inches long, and delivers a parallel bundle of rays from the slit to the grating. Finally, a short-focus Schmidt camera forms an image of the spectrum with a dispersion of 247 angstroms per millimeter, in the first order. Thus, on a panchromatic emulsion, which registers all visible wave lengths, the first-order spectrum extends about one centimeter, while the second-order spectrum, which joins onto that of the first order, is about twice as long.

Because of great care in perfecting his Schmidt camera, Meinel was able to obtain superb definition on his spectrograms; and during the past three years he has discovered several new radiations in the light of the night sky. For example, he has found the important bands of the hydroxyl molecule, which resembles water because it consists of hydrogen and oxygen, but differs from it in having only one atom of hydrogen (OH), while water has two (H_2O).

During the aurora, Meinel pointed the spectrograph toward two regions of the sky. In the accompanying spectra, reproduced with an engraving lent by the *Astrophysical Journal* (January, 1951), spectra *a* and *d*, obtained from the magnetic horizon, show a broadened but undisplaced Hα line. Spectrum *c* was obtained with the spectrograph pointed toward the magnetic zenith, in the direction where the magnetic line of force penetrates into the atmosphere above Yerkes Observatory. In this case, the Hα line is greatly shifted toward the violet of its normal position and is at the same time unsymmetrically shaded.

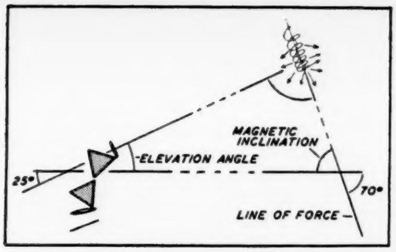
This shading must not be confused with a similar shading of the feature marked N_2^+. The latter is a molecular band, and its shading is caused by the complex structure of the nitrogen molecule. The hydrogen line, on the contrary, is intrinsically narrow, and its broadening in the auroral stream is entirely due to the motion of the solar

protons, which capture free electrons from our atmosphere and, by recombination, produce the well-known Balmer series, of which Hα is the first member.

The violet wing of the displaced Hα line in spectrum *c* indicates a shift of about 71 angstroms or a velocity of approach of 3,300 kilometers per second at one tenth the maximum ordinate, and the extreme violet edge may correspond to 4,000 kilometers per second. The strongest portion of the line is shifted about 450 kilometers per second, and represents the motion relative to the observer of the greatest numbers of the incoming particles.

Meinel concludes: "This velocity profile can be interpreted only as being due to the deceleration of the incident protons by the atmosphere." As the hydrogen protons enter the atmosphere with a speed of 3,300 kilometers per second, they encounter molecules of air and are partly deflected by them, as a billiard ball is deflected when it collides with a cluster of stationary balls. Thus, the forward motion is decelerated, and at the same time velocity components are built up at right angles to the incident stream.

Furthermore, the particles spiral toward the earth along a line of magnetic force, as shown in the accompanying diagram which has been supplied to us by Professor Vegard. The spectrograph is shown directed very nearly toward the magnetic horizon (90 degrees from the magnetic zenith), corresponding to Meinel's spectra *a* and *d*. The spiraling produces almost the same velocity components, as seen from the spectrograph, of approach and of recession, and the hydrogen line is therefore undisplaced, but it is broadened by the Doppler effects of the spiraling motion. Meinel's observation in strip *c* corresponds to a spectrograph placed about where the words "line of force" are lettered. In this position, the velocity is almost entirely one of approach, but by the time the particles have penetrated to the auroral region the majority of them have been slowed down by impacts and the spiraling action, which accounts for the maximum of intensity of the line being shifted only 450 kilometers per second toward the violet.



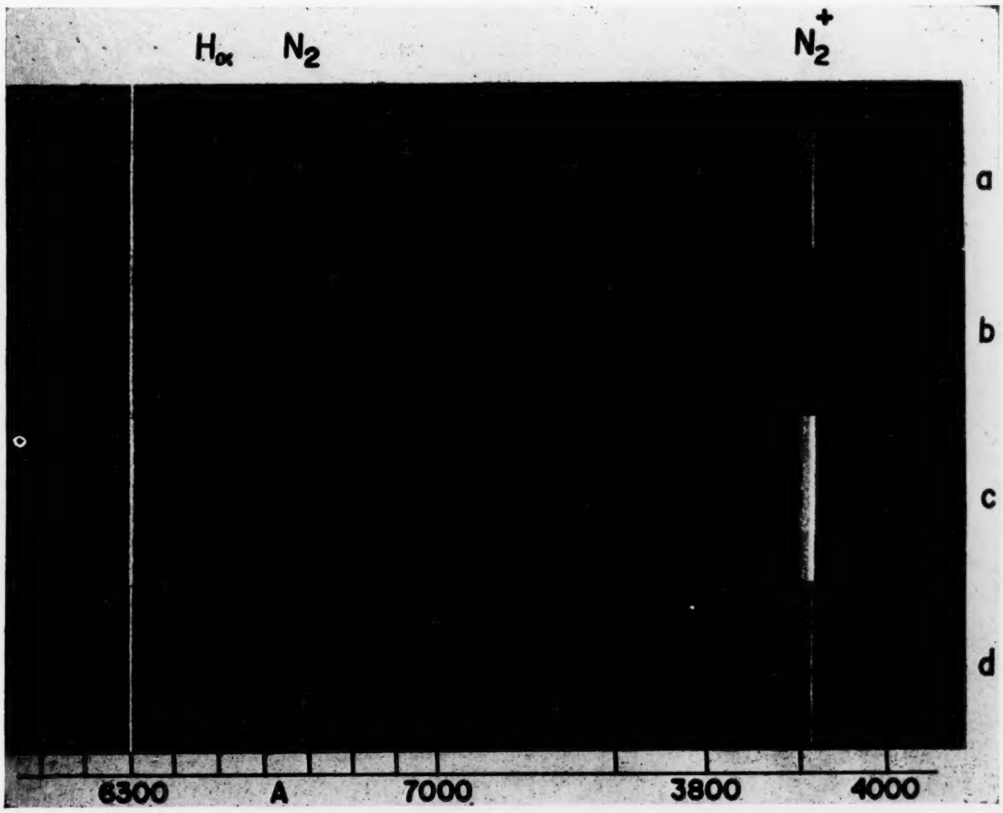
A diagram by L. Vegard to explain the behavior of the hydrogen lines in different parts of the sky.

Meinel has remarked that the hydrogen lines were observed by him while the aurora was in its earliest stages, as a relatively quiet arc extending over most of the sky. As soon as the arc broke up into "flaming" or pulsating surfaces (spectrum *b*), the hydrogen lines faded away. Hence, the display of an auroral corona (such as occurred at Ann Arbor while this article was being written, on July 1-2, 1951) is an aftereffect of the ionization produced by the original beam of solar protons. Dr. Gartlein writes, however, that the hydrogen lines are sometimes present even "when the sky is full of rays and nothing like an arc is present. In the arc the hydrogen-alpha line sometimes almost equals the forbidden oxygen line at 6364 angstroms." He suggests that the hydrogen is probably concentrated in the auroral arcs and is spread out through the rays.

The large velocity found by Meinel exceeds that estimated from the time lag between meridian passage of a solar *M* region and the beginning of a magnetic storm. But perhaps the particles travel in curved paths from the sun, or they may be accelerated when they come close to the earth.

The phenomena of auroras and magnetic storms are much more complicated than is generally recognized. There are, for example, the sunlit auroras discovered by Stoermer at elevations up to 1,000 kilometers. There are also magnetic disturbances and various changes in the ionization of the Ken-

(Continued on page 299)



The hydrogen - alpha region of the auroral spectrum (with an adjacent violet region of another order), photographed by A. B. Meinel in August, 1950, with the grating spectrograph pictured here. Spectra a, b, and d are from the magnetic horizon; c is from the magnetic zenith. Spectrum b is of a "flaming" aurora. An image of the sky 30 degrees long was projected on the spectrograph slit. Engraving, courtesy "Astrophysical Journal."

NEWS NOTES

By Dorrit Hoffleit

CO-OPERATION IN SOUTH AFRICA

The Royal Observatory at the Cape of Good Hope, founded in 1820 and the oldest observatory in South Africa, has, like most of the older observatories in the world, been suffering from the growth of cities, whose lights prevent many important astronomical activities. This observatory is well staffed, whereas the Radcliffe Observatory at Pretoria is understaffed and cannot make use of all the available observing time of its 74-inch reflector. This instrument, the largest south of the equator, began operation in 1948 in a location where observing conditions are fine.

Consequently, an agreement has been reached greatly assisting both institutions. The astronomers at the Cape will be given one-third observing time at the telescope. The payment the Radcliffe Observatory will obtain for this concession will enable it to obtain clerical and mechanical assistants to relieve the small scientific staff of time-consuming chores.

UNIVERSE HISTORY

Dr. George Gamow, of George Washington University, in the *American Scientist* summer issue, presents his current theoretical picture of the origin and evolution of the universe, starting from the primordial "ylem" and extending to the expiration of our own sun in the ever-expanding (never reshrinking) universe.

Within a half hour after the zero point of the present universe, the atomic species had been formed and the expansion was well on its way. But conditions were very much different from those of our common experience, for while light filling a lecture room now weighs only about as much as one bacterium, at that time radiant energy dominated the scene. Five minutes after "creation" the density of radiation was comparable with that of iron, and material particles "were helplessly thrown around like little chips of wood in the stormy ocean of radiation." After about 30 million years the densities of both radiation and matter became about equal to the present density within the galaxy, and the temperature was down to about 300° Kelvin (room temperature).

At this point, instability set in. Sir James Jeans has shown that a gravitating gas filling an unlimited space is unstable and breaks up into "gas balls" with empty space between them. By using nuclear considerations alone, Gamow finds that the masses expected for the individual "gas balls" are approximately the same as are those of the present smaller galaxies, lending confidence to the theory. But at this stage, the galaxies were dark, because the stars had not formed within them. Then followed the formation of "stellar gas balls," which contracted rapidly into stars in which nuclear reactions took place as their central temperatures increased to some 20 million degrees. From there on stellar and planetary evolution followed a "rejuvenated Kant-Laplace theory," the entire process for both stars and planets requiring only a few hundred million years.

Looking into the future, Gamow finds that expansion will continue indefinitely, the kinetic energies of the galaxies flying away from one another being a hundred times greater than their mutual gravitational energies. Thus, the galaxies will continue flying apart while their stars use up all their hydrogen fuel and explode into oblivion, the fate that awaits our sun some 47 billion years from now, if this picture is the correct one.

COSMIC RAYS FROM THE CRAB NEBULA

Four Japanese physicists, Y. Sekido, T. Masuda, S. Yoshida, and M. Wada, report to the *Physical Review* that observations made in the Shimizu tunnel from 1939 to 1944, at an equivalent water depth of 1,200 meters, indicate that the Crab nebula in Taurus may be a source of cosmic rays. They studied diurnal variations in very high-energy cosmic rays because rays of lower energy are largely scattered in the terrestrial as well as in other magnetic fields. The Crab nebula is relatively near to us, and it is believed that the deflection of high-energy cosmic rays in the galactic magnetic field should be negligible.

The Crab nebula is also a source of cosmic radio noise, and Unsöld, Ryle, Alfvén, and Herlofson recently suggested theoretically that it might be a source of cosmic rays, thus anticipating the present observations.

IN THE CURRENT JOURNALS

THE MEANINGS OF TIME AND SPACE IN PHILOSOPHIES OF SCIENCE, by Martin Johnson, **American Scientist,** July, 1951. "It seems possible that different kinds of scientists, in mathematical physics, in astronomy, and in psychology, utilise quite different conceptions when they talk about time, concepts not uniquely derived from our universal experience that events occur in a temporal sequence."

NATIVE ASTRONOMY IN MICRONESIA: A RUDIMENTARY SCIENCE, by Ward H. Goodenough, **Scientific Monthly,** August, 1951. "If we leave the Polynesians and return to their more obscure Micronesian cousins furthur west in the Carolines, we find enough scattered information on their navigational methods that by pulling it together we can begin to see how navigation by stars was accomplished and what kind of an astronomy was developed for this purpose."

THE ACCURATE MEASUREMENT OF TIME, by Dirk Brouwer, **Physics Today,** August, 1951. "The science of measuring time as it has been practiced for thousands of years is linked closely with astronomical observations. While the accuracy of time measurement has been vastly improved, the search for even greater precision is continuing."

MAGNITUDE OF SIRIUS

From time to time, readers inquire about the magnitude of some bright star that is given one value in one authentic publication and a different value in another. The determination of stellar magnitudes is always beset with difficulty, as in the case of Sirius, for which there are no other stars of comparable brightness. In the original Harvard Photometry it was listed as of magnitude -1.43, but in the Revised Harvard Photometry, published in 1908 and still used generally for bright stars, Sirius was brighter, at -1.58.

In his Darwin lecture last October, Dr. Joel Stebbins, former director of Washburn Observatory, reported a photoelectric determination of Sirius' brightness at -1.42, in close agreement with the earlier Harvard value. Comparisons were made with four stars in the north polar sequence and five stars near Sirius, and the new figure represents an average of individual values ranging from -1.32 to -1.52. Dr. Stebbins said, "I see no way out of the conclusion that the generally used visual magnitude of -1.58 is too bright, and that -1.42 is nearer right when referred either to the stars near the pole or to the other white stars in the vicinity of Sirius."

AMERICAN INSTITUTE OF PHYSICS

The 20th anniversary of the American Institute of Physics will be celebrated in Chicago October 23-27 by a joint meeting with its five founder societies, the Optical Society of America, the American Physical Society, the Acoustical Society of America, the Society of Rheology, and the American Association of Physics Teachers. On October 25th, there will be a special all-day symposium on "Physics Today" at the Chicago Civic Opera House. The speakers will be E. Fermi on the nucleus; E. U. Condon on the atom; J. C. Slater on the solid state; Harvey Fletcher on acoustics; E. H. Land on optics; and K. K. Darrow on physics as science and as art.

The institute was founded in 1931 as a federation of leading societies in physics. Its stated purpose is "the advancement and diffusion of physics and its applications to human welfare."

Amateur Astronomers

Western Amateurs Meet in San Diego

ONE HUNDRED and 18 persons registered for the third annual convention of western amateur astronomers, which opened in Balboa Park, San Diego, Calif., on August 13th.

Four feature addresses were given: "Interlinking of Amateur and Professional Astronomers," William T. Skilling, professor emeritus, San Diego State College. "Philosophy of the Two World Systems, Ptolemaic and Copernican, Under the New Light," Dr. Karel Hujer, University of Chattanooga. "From Earth into Space," Dr. Dinsmore Alter, director of the Griffith Observatory and Planetarium. "Amateur Observing," Walter H. Haas, editor of the *Strolling Astronomer.*

Tuesday evening, the color picture, The Story of Palomar, was shown with the joint compliments of California Institute of Technology and the Astronomical Society of the Pacific.

Fifteen papers were presented during the convention, their subjects including Mars, recent large sunspot groups, comet searching, grinding and polishing mirrors by spinning, telescope mountings, Barlow lenses, large apertures for planetary observing, convex optical surface testing with a knife edge, astronomy before the telescope, and others.

A large assortment of telescopes, mountings, drives, test equipment, photographs and paintings was exhibited.

On the last day of the convention, a visit was made to Palomar Observatory, where the 200-inch telescope and the 48-inch Schmidt instrument were shown and described by Palomar staff members, through the courtesy of Director Ira S. Bowen and the Mount Wilson and Palomar Observatories. A picnic supper and star party followed in Palomar State Park.

A board of representatives was provided for to seek a host society for the 1952 convention. They were also directed to study a proposal for the creation of an award to an outstanding amateur in memory of Dr. G. Bruce Blair, of Reno, Nev.

CARL W. DICKSON
6951 Mt. Vernon St.
Lemon Grove, Calif.

NEW YORK AMATEURS 25th SEASON

FOUNDED in 1927, the Amateur Astronomers Association, with headquarters at the American Museum of Natural History in New York City, now has about 750 members and a widely diversified program of activities. Lecture meetings are held on the first Wednesday of each month through the season; six different courses are conducted by members; weekend meetings out of town and a field trip are arranged each year; and the optical division has workshop facilities in the basement of the Hayden Planetarium for those interested in telescope making.

Classes this year include Beginners Astronomy, designed to cover constellation study, with outdoor observing and discussion of current astronomical events; Elementary Astronomy, a first course, with Baker's **Introduction to Astronomy** as a text; Intermediate Astronomy, a two-year detailed study, including the solving of problems, using this year the first half of Duncan's **Astronomy;** a seminar on Recent Advances in Astronomy, for discussion of astrophysics and current astronomical discoveries, with Struve's **Stellar Evolution** as a text.

In addition, a Home Study Course is conducted by mail for members unable to attend regular classes, and the Telescope Mirror-Making Classes in the optical division workshop include lectures and consultation on telescope design.

A special project of the Amateur Astronomers Association is an astronomical news service, whereby a monthly sky map and news article are distributed to subscribing newspapers in the United States

(Continued on the next page)

THIS MONTH'S MEETINGS

Cambridge, Mass.: On October 4th, before the Bond Astronomical Club, Richard B. Dunn, Harvard Observatory, will speak on "Some Problems of the Sun," and solar prominence motion pictures will be shown. The meeting is at 8:15 p.m., at Harvard Observatory.

Columbus, Ohio: On October 12th at 8 o'clock, Leon N. Zechiel will discuss "The Spectroscope," at the Columbus Astronomical Society meeting at the McMillin Observatory, Ohio State Univer-

Dallas, Tex.: John Hulme will speak on "Chemistry Applied to Astronomy," at the October 22nd meeting of the Texas Astronomical Society, 8:00 p.m. at the Dallas Power and Light Company auditorium. The public is invited.

Geneva, Ill.: The Fox Valley Astronomical Society will meet October 2nd, at 8:00 p.m. in the Geneva City Hall. Clarence R. Smith will talk about "Our Members in Picture and Story," and Frank Hancock will speak on "Earthquakes, Their Cause and Effects."

Indianapolis, Ind.: Dr. Harry E. Crull, Butler University, will talk on "Wonders of Our Milky Way," at the October 7th meeting of the Indiana Astronomical Society, at 2:15 p.m. in Cropsey Hall, Riley Library.

Madison, Wis.: A panel discussion on "How and Why I Got My Telescope" will be the feature of the October 10th meeting of the Madison Astronomical Society, 8 o'clock at Washburn Observatory. Harold Porterfield will be M. C., and speakers include J. H. Gieselman, Paul Hoover, and Frank Grams.

New York, N. Y.: The Amateur Astronomers Association will meet October 3rd to hear the first Clyde Fisher memorial lecture, at 8:00 p.m. in the Roosevelt Memorial building of the American Museum of Natural History. Willy Ley will speak on "Terrestrial Meteorite Craters." An informal reception will follow.

Washington, D. C.: The National Capital Astronomers will meet in the Department of Commerce auditorium on Saturday, October 6th, at 8:00 p.m. John W. Streeter, Fels Planetarium, will lecture on "Telescopes — Old, New, and Future."

The convention of western amateur astronomers at San Diego, August 13-15, 1951. In the front row are officers of various astronomical societies (left to right): Dr. Clarence P. Custer, Carl W. Anderson, Ira Shafer, Benjamin O. Lacey, Carl W. Dickson, Walter H. Haas, Harold W. Milner, David P. Barcroft, and Homer King. Photograph by Charles H. Leslie.

and Canada. A camera station is sponsored by the association, located at Westbury, Long Island, where a program of lunar and solar photography and photometry is in progress. The Amateur Astronomers medal is presented to amateurs from time to time for meritorious service to the science of astronomy. And in honor of Dr. Clyde Fisher, late curator of the Hayden Planetarium and founder and first president of the association, an annual Clyde Fisher memorial lecture, to be presented at the opening meeting each season, is being inaugurated this year.

A brochure, "Enjoy the Stars," describes in detail these activities and gives the schedule of lectures and classes for the 1951-52 season. Anyone interested in astronomy is invited to join the society, regular membership costing $5.00 a year and including **Sky and Telescope** as a privilege of membership. The brochure and further information may be had from George V. Plachy, secretary, Amateur Astronomers Association, American Museum of Natural History, Central Park West at 79th St., New York 24, N. Y.

SPACE TRAVEL EXHIBIT

The Sacramento Valley Astronomical Society is joining the Crocker Art Gallery, 219 O St., Sacramento, Calif., in a major exhibition on space travel from the earliest attempts to the present time, including jet propulsion and the first possible rocket to the moon. This exhibit, named for its feature attraction, some 50 original illustrations by C. Bonestell for the book, **The Conquest of Space,** opened on September 16th and will continue through November 30th. There will be other paintings relating to the struggle of man to conquer space.

The Sacramento amateurs have built a large model of the solar system with a sun model 12 feet in diameter and planets in scale hung in a gallery 114 feet in length. Charts, drawings, photographs, and transparencies are displayed, including a flashing transparency of the sun's corona and a mechanized model of the earth and moon showing a rocket in transit. A relief map of a section of the moon's surface and a model of the 200-inch telescope are also exhibited. Telescope making and optical equipment are included in the scientific exhibit.

A series of seven lectures was scheduled, mostly by members of the Sacramento society.

CHATTANOOGA AMATEUR DIES

On July 30, 1951, Clarence T. Jones died at the age of 71. He was an architect who had designed many well-known buildings in Chattanooga, Tenn., where he was permanent president of the Barnard Astronomical Society, founded in 1923. His greatest astronomical accomplishment was the design and construction of the University of Chattanooga Observatory. With the help of his two sons, Arthur and Bruce Jones, he made and mounted a 20½-inch Cassegrainian reflector, described in The SKY, III, 9, July, 1939. This instrument is in regular operation, open to the public each Friday night. His sons expect to complete a project started by Mr. Jones to equip the observatory with a projection planetarium.

Carolina Convention

TAPS of a gavel resounding from door to door brought sleepy conventionites to life in the 4:15 predawn darkness, Saturday, September 1st, to observe the annular eclipse. More than 200 members of the Astronomical League and their friends gathered at Piney Prospect, Chapel Hill, N. C., to greet the rising sun with their many telescopes and cameras. Due to clouds near the horizon, the annular phase of the eclipse was passed before the sun came into full view; those who went up in planes had a definite advantage over the ground observers. Nevertheless, many shutters clicked, and in what seemed only a few minutes the eclipse was over and the sungazers turned their attention to breakfast.

Early arrivals the previous day found the exhibit room at the Morehead Planetarium building a busy place, with T. W. Stone, of the Richmond Astronomical Society, doing the yeoman task of organizing the displays as quickly as they arrived. More than 40 exhibitors demonstrated items ranging from a solar prominence observatory (telescope, coelostat, spectroscope) to scrapbooks, observation reports, and a celestial globe 125 years old. Several commercial exhibits helped fill all the available space to make the most extensive exhibition at recent league conventions. The display of entries in the emblem contest enabled amateurs to compare their opinions with those of the judges.

At the registration desk nearby, under the direction of Elizabeth Fazekas, of the Norfolk Astronomical Society, amateurs were quickly oriented and on their way to their quarters. After the rush was over, Miss Fazekas announced a total registration of 218 persons, representing 35 societies and 22 states, as well as Canada, the Canal Zone, and Cuba. From 4:30 until 6 p.m., Mrs. Z. V. Conyers, Greensboro Astronomy Club, acted as hostess in the faculty lounge of the Morehead building, serving lime sherbet, ginger ale, and cookies.

On Friday evening, many attended the regular Morehead Planetarium lecture, "Eclipses of the Sun," during which, by means of an imaginary ditch in the earth, they could see the entire eclipse from first to fourth contacts reproduced with an attachment to the Zeiss projector. Afterwards, the visitors transferred to the north parking area, where Maurice Parson, Lansing, Mich., had supervised the assembling of instruments for observing Jupiter, Epsilon Lyrae, and other objects. In spite of the early hour of the next morning's eclipse, the telescopes were not put away until almost 11 p.m.

The convention was officially opened Saturday forenoon, in Howell Hall of the University of North Carolina, by the league president, Charles H. LeRoy, Amateur Astronomers Association of Pittsburgh. Dr. Douglas Duke, of the Morehead Planetarium, gave the welcoming address. The chief activity of this session was the reporting by member societies, under the direction of the executive secretary, Grace C. Scholz, National Capital Astronomers. Delegates present gave verbal accounts of their organizations' activities; other groups had furnished reports to Miss Scholz. Several described work with local television facilities in presenting programs to increase public interest in astronomy, indicating that this fertile field of endeavor should be investigated to the fullest extent by all societies. During this session, the convention assemblage stood in a moment of silent tribute to members and amateur astronomers who had died during the preceding year.

Paul W. Stevens, of the Rochester Academy of Sciences, who had observed the eclipse from the Blue Ridge Parkway near Grandfather Mountain, reached the convention just in time to assume his duties as chairman of the Saturday afternoon eclipse forum. Observers from far and near compared their results, generally to the effect that clouds interfered with or spoiled the show. Many of these reports are described on page 287 of this issue of *Sky and Telescope*.

A session for junior astronomers was

Travelers to the convention from remote points included Mr. and Mrs. Fernando Boytel, Santiago de Cuba (front row); Edwin V. Greenwood, Toronto, Canada (left rear), and Howard A. LeVaux, Los Angeles, Calif. All photographs with this article are by Robert E. Cox.

At the banquet Saturday evening, T. W. Stone, of the Richmond Astronomical Society, described a "very special" telescope purchased for a very small sum.

conducted by Edwin F. Bailey, of the Amateur Telescope Makers of the Franklin Institute. He introduced Armand N. Spitz, of Philadelphia, inventor of the Spitz planetarium, who explained the purposes and aims of the Westinghouse Science Talent Search. A recent prizewinner in the talent search, Richard M. Thomson, of the Schenectady Astronomy Club, described his project, a simple stellar photometer that produces an artificial star of variable intensity in the telescope field. The density wedge is made of 35-mm. film. He expects to improve the design to take color into account and to obtain a greater range in brightness for the comparison star.

At the third session Saturday afternoon, Dr. William A. Calder, of Agnes Scott College, demonstrated his equipment for observing solar prominences. He pointed out that a simple spectroscope mounted behind a small telescope had been used to observe prominences long before the development of more complicated modern instruments. H. J. Walls, of Washington, D. C., described a simplified wooden telescope mount that was on display in the exhibit room. During the discussion, it was suggested that beginners build simple mountings for their telescope mirrors, in order to get them into actual use promptly. Then they may develop mountings with castings and machine work while enjoying observations of the heavens.

Rolland R. LaPelle, Springfield Stars Club, observing chairman of the league, described and demonstrated a new filter for direct viewing of sunspots with a telescope. A plane-parallel glass is aluminized on the rear surface, so that it reflects 95 per cent of the light and heat down the optical axis and back toward the sun, with the remaining light passing through to the eyepiece, via a Willson filter as a safety factor. This simple device fits into the drawtube just ahead of the eyepiece. Many of the delegates had an opportunity to observe the sun through the filter on Sunday morning. Earlier use with a 10-inch telescope showed that the filter did not become excessively hot. Mr. LaPelle also described a glare-reducing screen, which helps with high magnifications when the seeing is only average, for example, during double-star observations.

At a special session, pictures of amateur observatories were shown, a number featuring domes made of silo tops. By an interesting coincidence, several domes had the same diameter as the Hale telescope mirror, 200 inches. The instrumentation chairman, Robert E. Cox, of the Stamford Museum, pointed out the advantages of a sliding-roof observatory. This type is not only cheaper to build, but faster to operate and less confusing to the public, as all of the sky can be seen instead of just a small section, by those inside the observatory.

On Saturday afternoon, a special demonstration was given in the Morehead Planetarium by W. D. Bulloch, who stripped the mystery from the Zeiss machine as he revealed its secrets to the delegates. He explained the arrangement of the star projectors, and demonstrated the operation of the "eyelids" that cut off the projection at the horizon. The aurora borealis was shown on the planetarium sky, but in the most startling effect of all the universe seemed to vanish as the service lights behind the dome of the planetarium chamber were turned on, showing the superstructure clearly through the thousands of perforations in the dome itself.

The banquet was held Saturday evening at the Carolina Inn, with Roy L. Dodd, Milwaukee Astronomical Society, secretary of the league, as master of ceremonies. An array of representative North Carolina products, from washcloths to headache powders, met each delegate at his place. Mr. Stone started off the evening on the convention theme, "Astronomy Is Fun," with his intensely amusing parody, "I Bought a Telescope." This fine instrument, complete with a dewcap, was such an irresistible bargain that his enthusiasm was hardly dampened by the fact that it consisted primarily of tin cans taped into a telescoping arrangement!

D. F. Mathe, of Pittsburgh, announced that James Karle, Portland, Ore., had won the emblem contest, the committee deciding to use his design with certain modifications for the emblem of the Astronomical League. Four honorable mentions were given: L. J. Mueller, Detroit; F. W. Long, Indianapolis; B. A. Benson, Chicago; and A. G. Priggett, Pittsburgh. Mr. LeRoy presented the Astronomical League award to Albert G. Ingalls, citing his advancement of amateur astronomy through his department in *Scientific American* magazine, his books and correspondence. In the absence of the award recipient, a typical "Unk" Ingalls letter of acceptance was read.

The principal address of the banquet was by Dr. Carl K. Seyfert, who described his efforts in arousing enthusiasm for astronomy in the Nashville, Tenn.,

Delegates gathered at the formation of the Southeast region of the league (clockwise from left front): F. C. Boland, Atlanta, Ga.; Dr. W. A. Calder, Atlanta; C. H. Holton, Atlanta; Mrs. F. R. Stout, Greensboro, N. C.; Mrs. Z. V. Conyers, Greensboro; Richard C. Davis, Raleigh, N. C.; Thomas G. Street, Greensboro; Mrs. A. M. Bonelli, Vicksburg, Miss.; Della McGoogan, St. Pauls, N. C.; James Waters, Atlanta.

The general convention of the Astronomical League, at the University of North Carolina, September

area. Rapid progress is being made on the new Vanderbilt University Observatory, primarily through material donations by businessmen of the community. Already a paved road has been built to the mountain site of the observatory south of the city, and actual construction should begin in the near future.

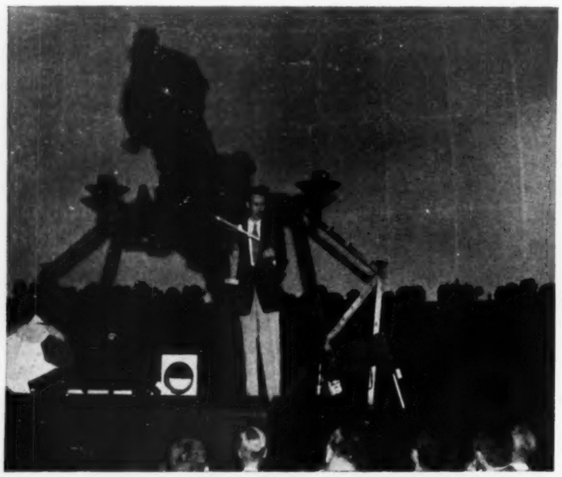
A. F. Jenzano, manager of the Morehead Planetarium, held informal open house at the Morehead building early Sunday afternoon. The art galleries, lounges, dining room, and terraces, as well as the Copernican orrery, were open for inspection. Earlier in the day many persons had taken the opportunity to visit the exhibit room at greater leisure.

Dr. Seyfert spoke again Sunday afternoon, opening the regular session with a discussion of eclipsing binaries. With the aid of blackboard sketches, he very graphically showed the immense amount of information that can be gleaned from proper observations of these variables. The Vanderbilt astronomer also gave information on photoelectric photometry, describing the use of the 1P21 electron tube. He was followed by Dr. Duke, who discussed the characteristics of interstellar matter, and its effect in reddening the light of the distant stars.

John W. Streeter, of the Fels Planetarium, was chairman of the solar system session. Owen Gingerich, of Goshen, Ind., discussed the use of radio time signals. Assisted by convention chairman G. R. Wright, of the National Capital Astronomers, he demonstrated how an amateur can pick up time signals from WWV in Washington to set his watch to the most accurate time in America. After setting their watches, everyone in the audience agreed on the time for once, and found that the convention was running 20 minutes behind schedule. Herbert A. Luft, of Elmhurst, N. Y., urged an organized observing program for halos of both the sun and the moon.

Special impetus was given to various phases of observational astronomy by several simulated observing sessions. The first of these came Sunday afternoon as the delegates sketched a flickering image of Jupiter under the direction of Mr. LaPelle. That evening, special instructions were given by Mr. Bailey on meteors and Mr. Streeter on variable stars, in preparation for the simulated observing period scheduled for Monday morning in the planetarium chamber. Mr. Bailey, who had remarked, "A bolide is really a rare bird; you're quite lucky if you see one in a lifetime," cooperated with the planetarium staff to produce about half a dozen exploding fireballs, sound included, on the planetarium sky. By slyly switching the illuminated cardinal points in the chamber, he threw the audience into considerable confusion, graphically illustrating the importance of keeping one's directions straight during a fireball observation. This was followed by a session in which the amateurs were given opportunity to plot the paths of several planetarium meteors. Then Mr. Streeter located several naked-eye variables and their comparison stars, and instructed in the technique of brightness estimates. Finally, the audience became lunar observers as they sketched a slide of the moon.

Mr. LaPelle gave a progress report on the Astronomical League's observing manual. It will contain a "get-acquainted" section by Dr. Harlow Shapley, of Harvard Observatory, chapters on the use of instruments and handbooks, methods of recording observations, and complete bibliographies.



Activities and special effects behind the scenes at a planetarium were described by W. D. Bulloch, chief lecturer of the Morehead Planetarium. Some of the devices that produce special effects were demonstrated.

Mr. Wright was elected president of the league for the coming year. Others elected were: Mr. Dodd, vice-president; Mr. Karle, secretary; and Russell C. Maag, Fulton, Mo., treasurer. Mr. Wright was formerly chairman of the Middle East region, the host for this general convention. His successor will be Mr. Bailey. Other regional officers elected at the Middle East region's business session were Mr. Stone, vice-chairman; Mrs. R. T. LuCaric, Baden, Pa., secretary; and Miss Fazekas, treasurer.

The executive secretary announced that three societies had been dropped from membership, and that nine new groups had joined, with the Rittenhouse Astronomical Society, Philadelphia, as the latest member. On the convention program, the league's 59 member or-

na, September 2, 1951.

ganizations were listed; located in 26 states, they represent a total of several thousand individual members. Organized at the convention was the Southeast region of the league, sixth region to be formed, with the Atlanta, Greensboro, Key West, Raleigh, and Winston-Salem societies participating.

Invitations for the 1952 general convention were extended by the Northwest region, to meet in Portland, Ore., and the Texas Astronomical Society, to meet in Dallas. After some debate, the voting favored accepting the Texas invitation. No date was set for the 1952 convention, but as the Astronomical League adjourned at noon on Labor Day, "See you in Texas" seemed the order of the day.

ED. NOTE: The foregoing account has been compiled from notes and information kindly supplied by Mr. and Mrs. R. T. LuCaric, Robert E. Cox, Betty G. Dodd, Owen Gingerich, and other persons.

PLANETARIUM IN IOWA

The Sanford Museum in Cherokee, Iowa, opened its first division this spring with the dedication of its planetarium, with a Spitz projector. Intended to house displays of educational and historical value, the museum will include natural history, and traveling exhibits of art and photography. The building, modern in design, incorporates a full floor below ground level, in part for display, and is arranged so that a second floor may be added.

The director is W. D. Frankforter, formerly connected with the University of Nebraska State Museum at Lincoln. The Sanford Museum was built and endowed by the Tiel Sanford Memorial Trust Fund established as a memorial to the son of Mr. and Mrs. W. A. Sanford, of Cherokee.

BOOKS AND THE SKY

MEN OF OTHER PLANETS

Kenneth Heuer. Pellegrini and Cudahy, New York, 1951. 160 pages. $3.00.

IN judging a book of the present sort, particularly if the reader be a professional or amateur astronomer, one must carefully differentiate between two aspects of scientific writing. In the first, the writer chooses the difficult problem of simply trying to attract people who have literally spent no more than a passing thought on astronomy. Such books are frankly propagandistic, with the avowed aim of trying to reach an enormous circle of readers. The author needs a device, a focal point, to spark the interest of the reader so that he may be persuaded to finish the book and, even more important, to retain sufficient interest in the subject that he will progress to perhaps more sophisticated works.

From this aspect, it is extremely valuable to have books such as that under review to compete with the nonsense written from no such laudable motives. Astronomers — both professional and amateur — should cherish and encourage writers such as Mr. Heuer until they are willing to do a better job themselves. This reviewer recalls with some humility an evening with Howard Blakeslee, of the Associated Press — being brought face to face with some of the difficulties a newspaper science writer encounters in holding the attention of the lay public in even one or two columns of newspaper reporting.

How much more difficult a task, then, does an author face in attempting to do in writing what he has perhaps been able to do somewhat more easily with all the props of a modern planetarium. Thus, Mr. Heuer has chosen the device of raising the interesting speculation as to the types of men possibly found on other planets. From the standpoint of a public demonstrably interested in the possibilities of men from other planets viewing us on flying saucers, the device is certainly a promising one.

From the standpoint of the thoughtful scientist, such a sentence as "We know so little about the planets, having never visited them, that a wonderful variety of things is possible," may bring only shuddering memories of his first encounter with the proof that cows certainly inhabit the moon. (Not knowing anything about the moon, the probability that there are not black cows thereon is one half, the same for red cows, and so on, and hence the probability that there are no cows of any color is $(\frac{1}{2})^n$ indicating that certainly there are cows on the moon.) Indeed, one may seriously question the statement in the foreword by Charles H. Smiley that the author always warns when he leaves well-established fact and begins speculation. For there are a number of statements in the book on this question of life on other planets similar to that on page 24, where it is said that those scientists who have studied exhaustively the question conclude that there are definitely inhabited worlds, while only those who have not studied the situation deny the possibilities of extraterrestrial residence.

Such assertions will, however, certainly not be read critically by the great public for which the book is aimed, and can serve only to stimulate their interest to hear out the author's remarks. And, in hearing out these remarks, the public cannot help but be informed on many facts —and particularly ideas—not likely otherwise to be encountered. From this aspect, then, the book represents an extension of the author's planetarium work with the public and should not be lightly dismissed because of its shortcomings in the second respect.

This aspect should be covered by a book aimed at presenting carefully evaluated factual information so that someone already mildly interested in astronomy finds something of value beyond that with which he is already acquainted. Regretfully, the reviewer is forced to remark that in this respect the book is almost valueless. Such a book should be critical, even though not exhaustive, and critical the author is certainly not. The lack of separation of fact and fancy has already been noted. Some "facts" not connected

with the speculations as to life on other planets, and stated as certainties at various points of the book, more closely resemble the wildest fantasies. For example, on page 127 we find that comet 1843I has been definitely established, by calculations, to have had at one time a temperature of some three billion degrees. We are assured on page 124 that comet 1845III had a nucleus 8,000 miles in diameter. Other remarks simply indicate a lack of critical thought by the author. On page 50 we are told that the absence of air and water on the moon precludes the possibility of surface change aside from meteor impact, thus neglecting the influence of the extreme heating and cooling of the rocks which must lead to flaking. In the main, however, these are details which only the professional or amateur astronomer will pick up, and they serve to detract from the book chiefly from this second aspect. Possibly, however, in the future it might pay to have such a book checked a bit more carefully prior to publication, so that it might suffer only from its limited scope and not from its inaccuracies.

Actually, there exists another aspect from which the book might be judged, that of science fiction. From this standpoint, however, or at least from that of the science fiction usually read in the astronomical circles with which the reviewer is acquainted, the book is also likely to prove less than inspiring. Good science fiction usually appeals to the scientist because of its dependence upon semilogical extension of at worst a caricature of a scientific dream. Sheer speculation is usually shunned, by either the editor or the reader. Mr. Heuer had a device, not an idea, in this book — which almost as certainly disqualifies it from the science fiction field as it ensures, we hope, its success in the general market.

RICHARD N. THOMAS
University of Utah

The Observations and Photochemistry Of Atmospheric Ozone and Their Meteorological Significance

Richard A. Craig. Meteorological Monographs, Vol. 1, No. 2, American Meteorological Society, 3 Joy St., Boston, 1950. 50 pages. $2.50.

IN GENERAL, written material which has as its aim the summarization of the efforts of many researchers, and the re-evaluation of their results in the light of more recent experimental data, presents an unusual problem to the critic. Fortunately, this monograph rises above the general run in manner of treatment. Within the first few paragraphs it becomes apparent that the author has spared little effort for research into earlier published material on the subject matter. Indeed, the bibliography found at the end of the text is the most complete on the subject ever seen by the reviewer. This feature alone makes the work worthwhile.

The book itself is comprised of 20 sections covering such matters as the history of the ozone problem, observational data, calculated distributions, and finally the meteorological significance of atmospheric ozone. Certainly some of the sections are of more importance than others. That which discusses the data to be used in the photochemical calculations is most interesting, because the V-2 rocket data for solar intensity (at the outer limit of the earth's atmosphere) are considered, as well as the pressure dependence of oxygen absorption above 1950 angstroms (after Heilpern). The actual calculations of ozone distribution and its dependence upon zenith angle are covered by a separate section, and the results of these calculations agree well with those obtained by other investigators. It might be mentioned in passing that the NACA (National Advisory Committee on Aeronautics) upper atmosphere temperatures were used in the calculations, even though subsequent V-2 rocket data showed these to be rather high above 30 kilometers. However, as the author points out, the percentage of total ozone formed above 32.5 kilometers is small.

The most controversial part of the subject matter, and to this the author devotes much space, is the disagreement between calculated and observed heights of maximum concentration and the latitude distribution of ozone. For instance, calcula-

tions show that the total amount of ozone should decrease with increasing latitude, whereas observations indicate a maximum concentration at 60° north. Further, the computed maximum concentration is higher and sharper than that observed. Theories (advection and convection) have been advanced to explain day-to-day and seasonal variations in the ozone distribution. The day-to-day variations apparently are explained by such theories, but the seasonal variations continue to present an enigma. The latitudinal variations of ozone are attributed mainly to the horizontal and vertical circulations in the lower stratosphere.

WARREN BERNING
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HYDROGEN SHOWERS — II

(Continued from page 291)

nelly-Heaviside layer that are produced by ultraviolet light from the sun. It is possible that we shall finally be led to adopt a combination of several theories to explain the aurora. The fading of the hydrogen lines, and their absence in most of the milder displays, shows that we are not normally concerned with the primary mechanism of solar particles. As Vegard has suggested, the approach of a stream of corpuscles from the sun is accompanied by the production of extraterrestrial electric currents which modify the magnetic field of the earth.

It may even be profitable to remember the atmospheric theory of auroras by Maris and Hulburt which, in a convincing manner, demonstrates the possibility that the earth is surrounded by a kind of atmospheric halo, extending to a distance of some 50,000 kilometers above the surface, and conceivably taking part in the production of the aurora, as well as giving rise to something like the earth's tail discussed by Fessenkoff (see page 217 of the July issue of *Sky and Telescope*). But our atmosphere contains very little hydrogen; and the observations have now established that whatever other effects there may be the earth is certainly being bombarded, from time to time, by solar protons and their accompanying free electrons.

The phenomenon of "corpuscular radiation" plays an important role in modern theories of stellar evolution. Perhaps even now an estimate can be made of the amount of matter which the sun loses in this manner per second, or per year. Undoubtedly, we are observing in an aurora, on a small scale, the same process that on a much grander scale gives rise to the expanding shells of Wolf-Rayet and P Cygni-type stars.

GLEANINGS FOR ATM's

EDITED BY EARLE B. BROWN

How to Build a Quartz Monochromator — VII

By Richard B. Dunn, *Harvard Observatory*

PHOTOGRAPHY of the prominences gives permanent records that may be studied at leisure and compared with pictures taken elsewhere during the same period of prominence activity. Also, such pictures can be used as the basis for group discussions of solar phenomena. Thus, it is well for the amateur to equip his monochromator with facilities for prominence photography.

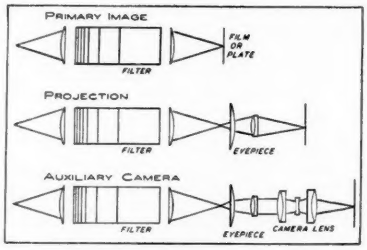
The author has been fortunate in having available recently the 15-inch refractor of Harvard Observatory, which with a focal length of 270 inches gives an image of the sun 2.5 inches in diameter. The average amateur will not have the advantage of such a long focus, and will need to use one of the three arrangements sketched here to obtain a larger image for photography. A large prominence just fits into a 35-mm. frame with the 2.5-inch image of the 15-inch refractor, but if the prominence has fine detail, and if the seeing is very good, larger images are used. The three arrangements then give solar images of 3.6, 4.5, and 7.2 inches, but it is well to keep the re-imaging magnification as low as possible. Generally, the primary image should be close to the film image size.

Focusing must be done very accurately. The author uses a 35-mm. single-lens reflex camera with and without the lens. The reflex feature simplifies the focusing problem, for it is used before each picture is taken and then snapped out of the way in an instant. Some other types of camera are equipped with ground glass that may be inserted in the focal plane and used for focusing; these are also convenient. In the absence of either reflex or ground glass, focusing for the first and third arrangements must be done by trial and error. Make a series of exposures on a photographic test strip, changing the focus a recorded amount so that the correct setting may be selected after the test strip is developed.

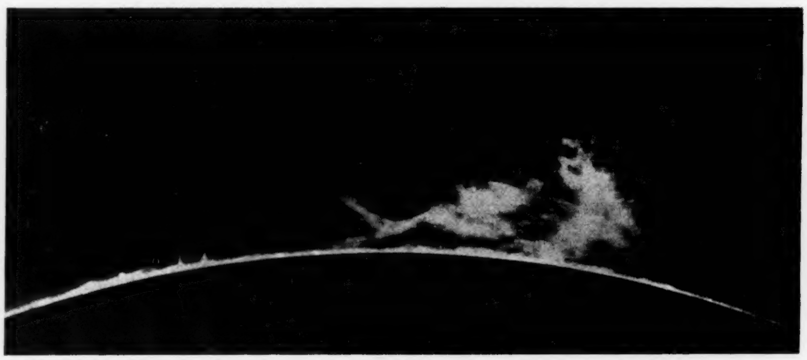
For prefocusing with the second system, both the camera and eyepiece are set on infinity. First, remove all the parallax between the field and the occulting disk by means of the eyepiece, collimator, or instrument focusing adjustments. The disk and field will then be in the same plane even if the eye is not focused to infinity. Next, focus a low-power (2x to 4x) telescope on a distant object. Place this telescope behind the eyepiece and visually focus the monochromator eyepiece until a sharp image is seen. The light will then be more nearly parallel than if the eye alone is used to focus for infinity.

A deep-red-sensitive emulsion must be used, but if it is sensitive too far in the red the infrared will be superimposed on the picture, as it is not completely eliminated by the filter. In other words, the film sensitivity should drop off as quickly as possible at wave lengths longer than hydrogen-alpha. Kodak Panchromatic C and E have been used by me successfully, but the B emulsions or 35-mm. Plux-X, Super-XX, and Panatomic-X, are not sensitive enough in this region. Linagraph Pan, a special copying film, is C and can be used. The best emulsion of all is Kodak 103a-E spectrographic emulsion, which must be ordered specially. Sky conditions and seeing generally force the use of fast, grainy emulsions. Among cut films some press film has a C-type emulsion. Color film has no advantage with the monochromatic light transmitted by the filter.

The actual exposure depends on sky



The various arrangements whereby the monochromator may be employed in connection with prime-focus or enlarged images when prominences are being photographed.



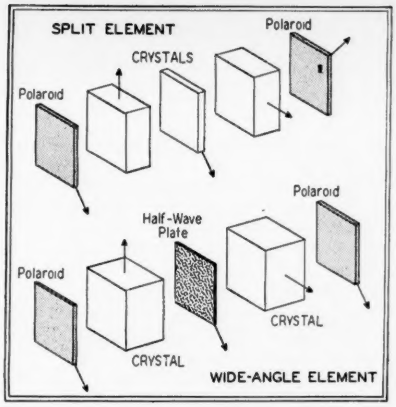
Solar prominences photographed on the morning of May 9, 1951, at 1/250 second with the 15-inch refractor at Harvard by Richard B. Dunn.

brightness, telescope aperture, image size, filter aperture, polaroid transparency, and band width. Exposures range from two seconds to 1/250 second depending on both the instrument and the sky. The author's exposures ranged from 1/25 second for the 7.2-inch image to 1/250 for the 2.5-inch image. A much shorter exposure is needed for the chromosphere than for the prominences. In setting up the photographic procedure, there is no substitute for experimentation.

All observations, including tests, should be recorded in an observing book. An observation form is useful in keeping track of the prominences. It should include place for the observation number, date, observer, seeing, weather conditions, and comments, as well as a solar disk for marking positions of prominences and spots. The observation number can be written in the corner of each film for identification.

After you have mastered the simple filter, several interesting modifications might be considered. For instance, by changing the temperature, the passbands may be shifted as much as 25 angstroms. Using a single six-plate birefringent filter and various glass filters, Lyot managed to get eight lines of prominences, solar corona, and the aurora borealis.

Much of the light absorption in the filter is in the polaroids. Thus, with fewer polaroids the exposure time may be shortened or finer-grain emulsions can be used. The split-element design, illustrated here, is an innovation to permit eliminating a number of the polaroids. A thick element is cut in two and a second element is placed between at 45° to the axis of the split crystal. The polaroids must be used with their axes crossed. This modification, as well as those described below, are treated in detail by Evans in the **Journal** of the Optical Society of America, **39**, 229-242, 1949.



The split-element arrangement is designed to lessen the absorption of light in the polaroids by reducing their number. The wide-angle arrangement produces a narrow passband and a wide field of view.

When a narrow passband and a wide field are desired, the thickest elements must be built for a wide angle. In the simplest type, pictured here, the thickest element is split in half, the axis crossed, and a half-wave plate inserted at 45° to the crystal axis. This design is called Lyot's first type. In Lyot's second type, the thick components consist of two different materials, the axes are again crossed, but no half-wave plate is required.

All designs that have quarter- and half-wave plates work well at only one wave length. A simple achromatic wave plate is still nonexistent.

The filter can be made variable so that any reasonable wave length can be "tuned in." Each element can have a slightly variable thickness by making one end a wedge. The change in thickness need only correspond to one $\mathbf{d}_0$, or half a $\mathbf{d}_0$ if the polaroids are crossed. Some of the wedge tolerances are small, and require accurate work. The angles can be made so the crystal thicknesses remain in the 1:2:4 ratio. If they do not remain in the proper ratio, cams will be needed to vary each wedge. Another technique would be to add a quarter-wave plate to each element, and then rotate individual elements about the optical axis of the instrument. This design will work well over a considerable wave-length region, even though the quarter-wave plates are not achromatic.

This filter could be supplemented by one using the rotatory dispersion of quartz. However, it is not practicable to build the entire filter on this basis, as the rotatory dispersion is inadequate to produce a passband narrow enough for solar work.

If additional information on these special designs is desired, the author will be glad to receive correspondence on this subject.

THE END

OBSERVER'S PAGE

Universal time is used unless otherwise noted.

Visual Observing Programs for Amateurs — XIX

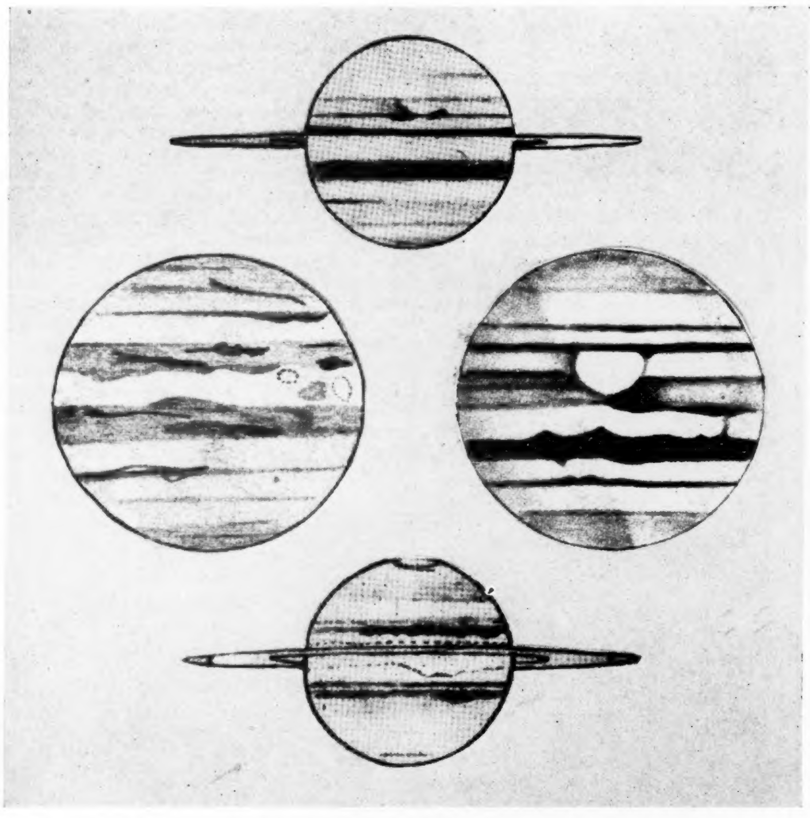
Observing the Moon and Planets—(cont.)

Transits on Jupiter. As we look through the telescope we see dark belts and light zones on Jupiter lying parallel to its equator. It has been suggested that these are somewhat analogous to the trade winds on the earth, which tread always in the same path, hence "tread" or "trade" winds. For some unknown reason some of these Jovian cloud bands rotate faster than others. In general, the bands near Jupiter's equator rotate in a shorter time than those in higher latitudes, but there are exceptions to this. If we can determine the rotation periods of the belts, and any variations in these periods which may occur from time to time, we may eventually improve our conceptions of the atmospheric circulation of Jupiter.

The method employed to determine these rotation periods is referred to as "Jovian transits." Pick out a prominent feature on one of the bands, such as the preceding end of the Red Spot Hollow. This marking moves westward (to the left in a simply inverted view), and disappears within an hour and a half after it passes the central meridian, but about eight hours later it comes around again. Usually it cannot be observed then because it is daytime for the same observer, but if we look again two days after our first observation, or more nearly 49½ hours later, this marking will have made five turns around Jupiter, at a rate of about one in every nine hours and 55 minutes. We merely note the time to the nearest minute when the mark seems to be exactly on the middle north and south line of the disk itself, that is, on Jupiter's central meridian, and time it about 49½ hours later, when it again is central. If we can once more see the marking two more days later we can, of course, refine the accuracy of our determination.

Drawings of Jupiter. These may help in identifying the prominent objects which we use when doing transit work. Such drawings are good training for other more difficult work such as sketching Mars. As Jupiter rotates rapidly, a sketch should be completed in 10 minutes or less, before the appearance of the planet alters too much. Such sketches may give considerable personal satisfaction, but they are of limited scientific utility. Do not send them in to the ALPO except on request, but hold them in your own files.

Saturn. Very few markings are seen on Saturn which are distinct enough to use for transit purposes. If such a marking



Drawings of Saturn by T. Cragg (top) and D. O'Toole (bottom), with 6-inch reflectors; and of Jupiter by T. Cragg (left) with a 6-inch reflector, and by T. Saheki (right) with an 8-inch reflector. Reproduced from the "Strolling Astronomer," edited by Walter H. Haas.

is seen, it is requested that you telegraph at once to Mr. Haas, and also make every effort to use it to the full yourself to determine the rotation period of the belt or zone on Saturn in which the object lies, in the manner described above for Jupiter. The period will presumably be around 10¼ or 10½ hours.

Drawings of Saturn. You can usefully make drawings of Saturn two or three times a month, in case anything out of the way may be discovered later which may require reference to your drawings. Making a drawing is good practice and attracts one's attention to details. The drawing should include the rings as nearly to scale as possible. The visibility of the shadow of the rings on the ball and the shadow of the ball on the rings back of it should be noted; the latter vanishes at opposition. Such observations give factual information upon how narrow a line can be seen under telescopic conditions, since the exact angular width of these narrow shadows can be calculated from the solid geometry of the situation.

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VARIABLE STAR MAXIMA

October 6, T Centauri, 6.1, 1336**33**; 13, R Sagittarii, 7.2, 1910**19**; 14, V Monocerotis, 7.1, 0617**02**; 21, R Leonis Minoris, 7.2, 093934; 30, RT Cygni, 7.4, 194048.

These predictions of variable star maxima are by the AAVSO. Only stars are included whose mean maximum magnitudes are brighter than magnitude 8.0. Some, but not all of them, are nearly as bright as maximum two or three weeks before and after the dates for maximum. The data given include, in order, the day of the month near which the maximum should occur, the star name, the predicted magnitude, and the star designation number, which gives the rough right ascension (first four figures) and declination (bold face if southern).

DEEP-SKY WONDERS

MANY amateurs do not realize that all the faint objects listed in this column **can** be observed with the average amateur instrument if the precise position is known, and sufficient care is taken to dark-adapt the eye. The Barnard galaxy, NGC 6822, described in the August issue, is a pointed example. On August 4th, the writer had the extreme pleasure of attending one of the summer observing parties of the St. Louis Amateur Astronomical Society, and, with the skilled help of their president, Stuart O'Byrne, we made a careful study of 6822 through three different instruments.

Although this is considered a difficult object, we were able to see "something" in both a 2-inch instrument of 33 power, and a 3½-inch refractor of 50x. In a fine 10-inch reflector of 90x, uncoated ocular, the outline could be pretty well seen, and, on changing to a coated eyepiece giving 120x, the galaxy was very well seen by everyone who looked. We did find that knowing its exact location was absolutely essential. We would never have noticed it in sweeping, partly because of its large size, partly because of its faintness. But by a very careful study of the finder chart, identifying star after star until we **knew** the exact location, we finally achieved this most elusive object. The group also much enjoyed comparing the telescopic view of M16 in Serpens with the magnificent 200-inch photograph in the August **Sky and Telescope**, pages 246 and 247.

For October the amateur can do no better than to turn his instrument upon NGC 7078, M15, $21^h\ 27^m.6$, $+11°\ 57'$, the great globular cluster just preceding Enif. Maraldi discovered it on September 7, 1746, although Hevelius may have seen it earlier, according to Messier. By 1892 Roberts had taken its photograph, and by 1898 Bailey was investigating its variable stars — an activity still hotly pursued today, a half century later. Amateur instruments will resolve its edges, and long contemplation will prove most soul satisfying.

WALTER SCOTT HOUSTON

PREDICTIONS OF BRIGHT ASTEROID POSITIONS

Eurynome, 79, 9.3. Oct. 1, 2:17.9 +14-32; 11, 2:12.9 +13-32; 21, 2:05.7 +12-15; 31, 1:57.4 +10-53. Nov. 10, 1:50.3 +9-35; 20, 1:45.0 +8-34.

Liguria, 356, 9.7. Oct. 1, 2:29.9 +22-23; 11, 2:24.6 +23-06; 21, 2:16.2 +23-28; 31, 2:06.2 +23-30. Nov. 10, 1:56.2 +23-16; 20, 1:47.8 +22-53.

Kalliope, 22, 9.3. Oct. 11, 3:16.6 +7-30; 21, 3:09.9 +7-30; 31, 3:01.1 +7-32. Nov. 10, 2:51.4 +7-39; 20, 2:41.9 +7-55; 30, 2:33.7 +8-23.

Parthenope, 11, 9.2. Oct. 21, 3:31.1 +11-19; 31, 3:22.7 +10-39. Nov. 10, 3:13.0 +10-01; 20, 3:03.2 +9-30; 30, 2:54.5 +9-11. Dec. 10, 2:48.1 +9-07.

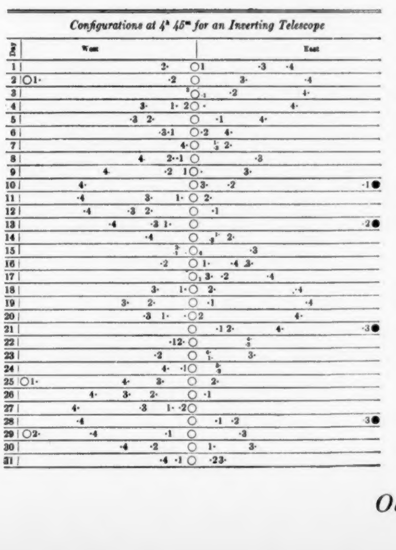
The following continues the ephemeris of Ceres published in the August issue. The asteroid resumes direct motion in this period, and its approximate magnitude is 8.3.

Ceres, 1, Oct. 1, 22:48.1 −23-51; 11, 22:42.9 −23-45; 21, 22:39.8 −23-21; 31, 22:39.1 −22-40. Nov. 10, 22:40.8 −21-47; 20, 22:44.5 −20-42; 30, 22:50.1 −19-29. Dec. 10, 22:57.3 −18-09.

After the asteroid's name is its number and the magnitude expected at opposition. At 10-day intervals are given its right ascension and declination (1951.0) for 0^h Universal time. In each case the motion of the asteroid is retrograde. Data supplied by the IAU Minor Planet Center at the University of Cincinnati Observatory.

JUPITER'S SATELLITES

Jupiter's four bright moons have the positions shown below for the Universal time given. The motion of each satellite is from the dot to the number designating it. Transits of satellites over Jupiter's disk are shown by open circles at the left, eclipses and occultations by black disks at the right. The chart is from the American Ephemeris and Nautical Almanac.



SKY-GAZERS EXCHANGE

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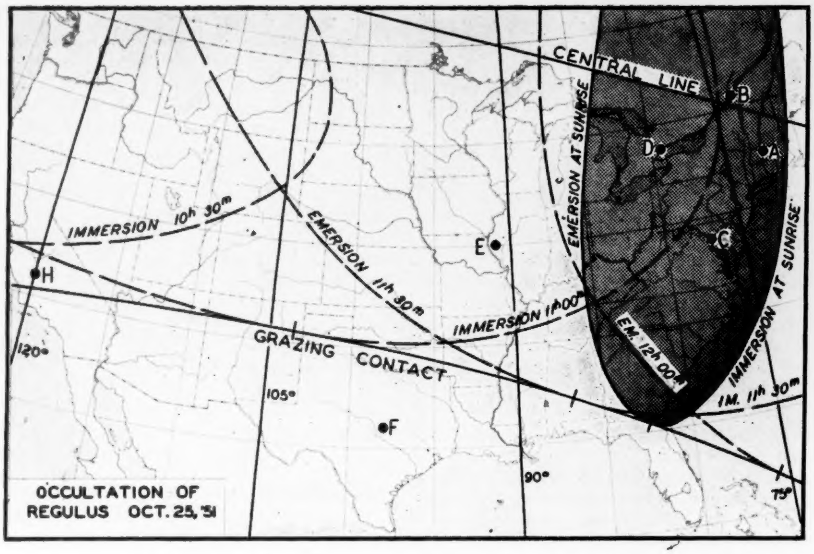
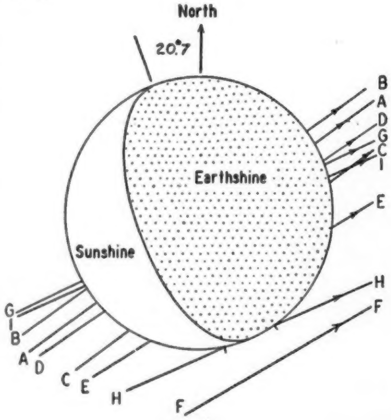


This map and the diagram below are by Paul W. Stevens.

OCCULTATION OF REGULUS

The second occultation of Regulus visible in the United States in 1951 occurs on the morning of October 25th. Times of immersion and emersion and the regions of visibility in this country are shown on the accompanying map. The diagram indicates the position angle of the cusps of the crescent moon and the apparent path of Regulus behind the lunar disk as seen from the standard stations.

It is interesting to compare the circumstances of this occultation to that of June 10-11 described on page 204 of the June issue of **Sky and Telescope.** In the two cases, the fraction of the moon's disk illuminated by direct sunlight is about the same. As before, a shaded area on the map indicates the region where contact at the bright limb occurs during twilight, while that at the dark limb takes place in daylight. The high altitude of moon and star on October 25th should render conditions extremely favorable for observing the daytime emersion along the Atlantic Coast. It will be interesting to watch for the star to blink through the lunar valleys along the limb if one is favorably located along the line of grazing contact, in the southern United States. South of this line a very close conjunction will be seen.



On the following morning, the moon and Regulus will present a striking configuration with the brilliant planet Venus, which will itself be occulted after it has passed below the horizon. Accordingly, in the dawn of October 26th the three bodies will appear to lie in a straight line. Mars will be nearby, but noticeably out of line.

PAUL W. STEVENS

OCCULTATION PREDICTIONS

October 7-8 **Tau Sagittarii** 3.4, 19:03.9 −27-44.6, 7, Im: **B** 0:40.9 −1.3 −0.5 72; **D** 0:33.6 −1.5 −0.2 68; **E** 0:14.1 −1.8 +0.4 62; **F** *23*:54.6 −2.3 +0.7 72. Em: **E** 1:32.2 −1.8 −0.5 266; **F** 1:20.8 −2.2 0.0 258.

October 10-11 **Iota Aquarii** 4.4, *22*:03.8 −14-06.5, 10, Im: **G** 3:16.1 −2.0 +0.3 107; **H** 3:00.9 ... ... 128; **I** 2:58.8 −1.6 +1.0 96. Em: **H** 3:25.3 ... ... 163.

October 11-12 **Lambda Aquarii** 3.8, *22*:50.1 −7-50.5, 11, Im: **A** 1:45.1 −0.6 +1.9 15; **B** 1:50.6 −0.3 +2.0 7; **C** 1:34.7 −0.6 +2.2 13; **D** 1:45.2 0.0 +2.6 358; **F** 1:07.3 ... ... 344. Em: **A** 2:47.7 −2.2 −0.1 266; **C** 2:36.8 −2.4 +0.1 267; **F** 1:32.3 ... ... 305.

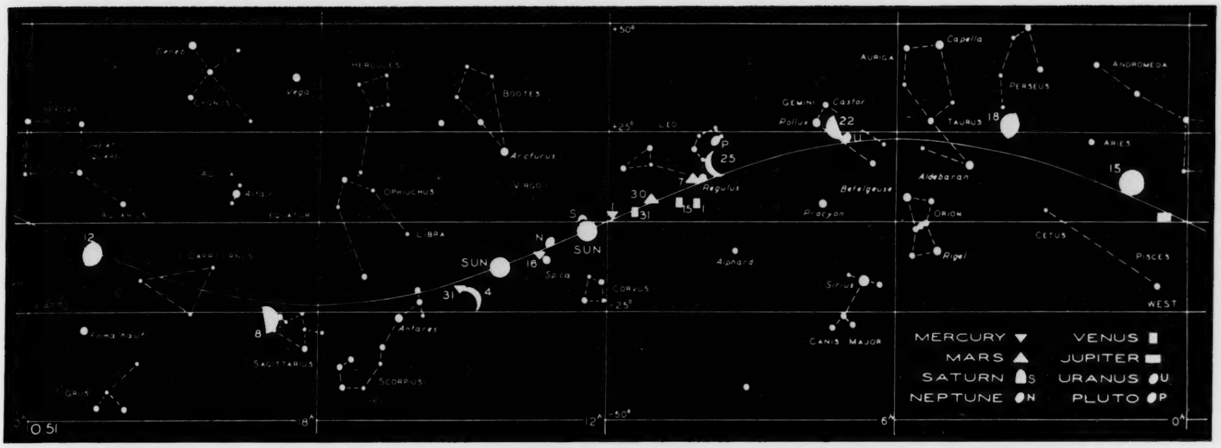
October 16-17 **Epsilon Arietis m** 4.6, 2:56.4 +21-08.7, 16, Im: **A** 1:39.5 −0.3 +1.8 62; **C** 1:32.1 −0.1 +1.8 *62*; **E** 1:35.7 +0.3 +1.9 44. Em: **A** 2:45.3 −0.7 +1.9 241; **B** 2:50.1 −0.7 +1.8 248; **C** 2:35.8 −0.5 +1.8 242; **D** 2:42.9 −0.6 +1.7 253; **E** 2:30.8 −0.4 +1.5 *263*; **G** 2:35.0 −0.5 +0.9 311.

October 17-18 **Eta Tauri** 3.0, 3:44.6 +23-57.3, 17, Em: **B** 0:16.8 +1.2 +2.7 185.

October 24-25 **Alpha Leonis, Regulus** 1.3, 10:05.8 +12-12.5, 24, Im: **A** 11:05.4 −1.5 −0.9 131; **B** 11:01.6 −1.4 −0.5 123;

UNIVERSAL TIME (UT)

TIMES used on the Observer's Page are Greenwich civil or Universal time, unless otherwise noted. This is 24-hour time, from midnight to midnight; times greater than 12:00 are p.m. Subtract the following hours to convert to standard times in the United States: EST, 5; CST, 6; MST, 7; PST, 8. If necessary, add 24 hours to the UT before subtracting, and the result is your standard time on the day preceding the Greenwich date shown.



C 11:03.7 —1.2 —1.7 149; D 10:54.9 —1.3 —0.8 135; E 10:46.8 —1.0 —1.9 159; G 10:24.9 —0.4 +0.7 120; H 10:38.1 ... ... 192; I 10:21.2 —0.2 +0.6 121. Em: A 12:28.4 —1.7 —1.1 301; B 12:23.2 —1.5 —1.2 307; C 12:21.9 —2.3 —0.3 283; D 12:15.1 —1.8 —0.5 293; E 11:50.3 —2.2 +1.4 264; G 11:31.6 —0.8 +0.8 291; H 10:51.7 ... ... 215; I 11:24.5 —0.5 +1.1 286.

For standard stations in the United States and Canada, for stars of magnitude 5.0 or brighter, data from the American Ephemeris and the British Nautical Almanac are given here, as follows: evening-morning date, star name, magnitude, right ascension in hours and minutes, declination in degrees and minutes, moon's age in days, immersion or emersion; standard station designation, UT, a and b quantities in minutes, position angle on the moon's limb; the same data for each standard station westward.

The a and b quantities tabulated in each case are variations of standard-station predicted times per degree of longitude and of latitude, respectively, enabling computations of fairly accurate times for one's local station (long. Lo, lat. L) within 200 or 300 miles of a standard station (long. LoS, lat. LS). Multiply a by the difference in longitude (Lo — LoS), and multiply b by the difference in latitude (L — LS), with due regard to arithmetic signs, and add both results to (or subtract from, as the case may be) the standard-station predicted time to obtain time at the local station. Then convert the Universal time to your standard time.

Longitudes and latitudes of standard stations are:

A +72°.5, +42°.5	E +91°.0, +40°.0
B +73°.6, +45°.6	F +98°.0, +31°.0
C +77°.1, +38°.9	G +114°.0, +50°.9
D +79°.4, +43°.7	H +120°.0, +36°.0
I +123°.1, +49°.5	

PHASES OF THE MOON

New moon	October 1,	1:57
First quarter	October 8,	0:00
Full moon	October 15,	0:51
Last quarter	October 22,	23:55
New moon	October 30,	13:54
First quarter	November 6,	6:59

	October	Distance	Diameter
Perigee	7, 7^h	229,900 mi.	32′ 18″
Apogee	21, 17^h	251,300 mi.	29′ 33″
	November		
Perigee	2, 13^h	227,200 mi.	32′ 41″

MINIMA OF ALGOL

October 3, 5:51; 6, 2:40; 8, 23:28; 11, 20:17; 14, 17:06; 17, 13:54; 20, 10:43; 23, 7:32; 26, 4:21; 29, 1:10; 31, 21:58. November 3, 18:47; 6, 15:36.

These predictions are geocentric (corrected for the equation of light), based on observations made in 1947. See Sky and Telescope, Vol. VII, page 260, August, 1948, for further explanation.

THE SUN, MOON, AND PLANETS THIS MONTH

The sun, on the ecliptic, is shown for the beginning and end of the month. The moon's symbols give its phase roughly, with the date marked alongside. Each planet is located for the middle of the month and for other dates shown.

Mercury, located first in the morning sky, passes superior conjunction with the sun on October 13th and enters the evening sky. The planet will not be well situated for observation until next month.

Venus, at its most spectacular showing of the year, attains greatest brilliancy of magnitude —4.3 on October 10th. The planet appears in the morning sky, rising nearly four hours before the sun during late October. The illuminated portion of the disk more than doubles during the month, from 19 to 42 per cent, as Venus drops rapidly behind the sun.

Mars remains a 2nd-magnitude object in the morning sky, moving eastward in Leo. All month Mars will be a short distance above Venus, and on the morning of October 3rd, Mars passes less than a degree north of Regulus.

Jupiter rises just north of the east point at sunset and dominates the sky until Venus rises in the morning. Opposition with the sun takes place on October 3rd, when Jupiter is 366,800,000 miles from the earth. This will be the closest Jupiter comes to us for the next 11 years. At opposition, its disk will be 49″.9 in diameter at the equator. Jupiter will be moving westward in a corner of Cetus. This is not uncommon — the moon and planets can travel in a number of constellations other than zodiacal ones.

Saturn reappears as a morning object in late October, rising about two hours before the sun. It is moving eastward in central Virgo.

Uranus rises well before midnight and may easily be located with the aid of small binoculars. Of the 6th magnitude, it is virtually stationary all month about 2° north of Zeta Geminorum.

Neptune cannot be observed this month, for conjunction with the sun occurs on the 13th.

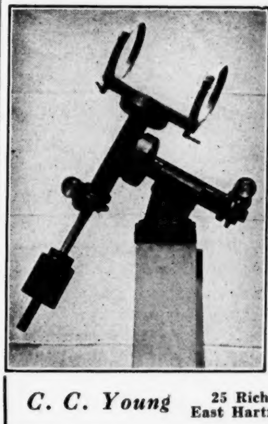
E. O.

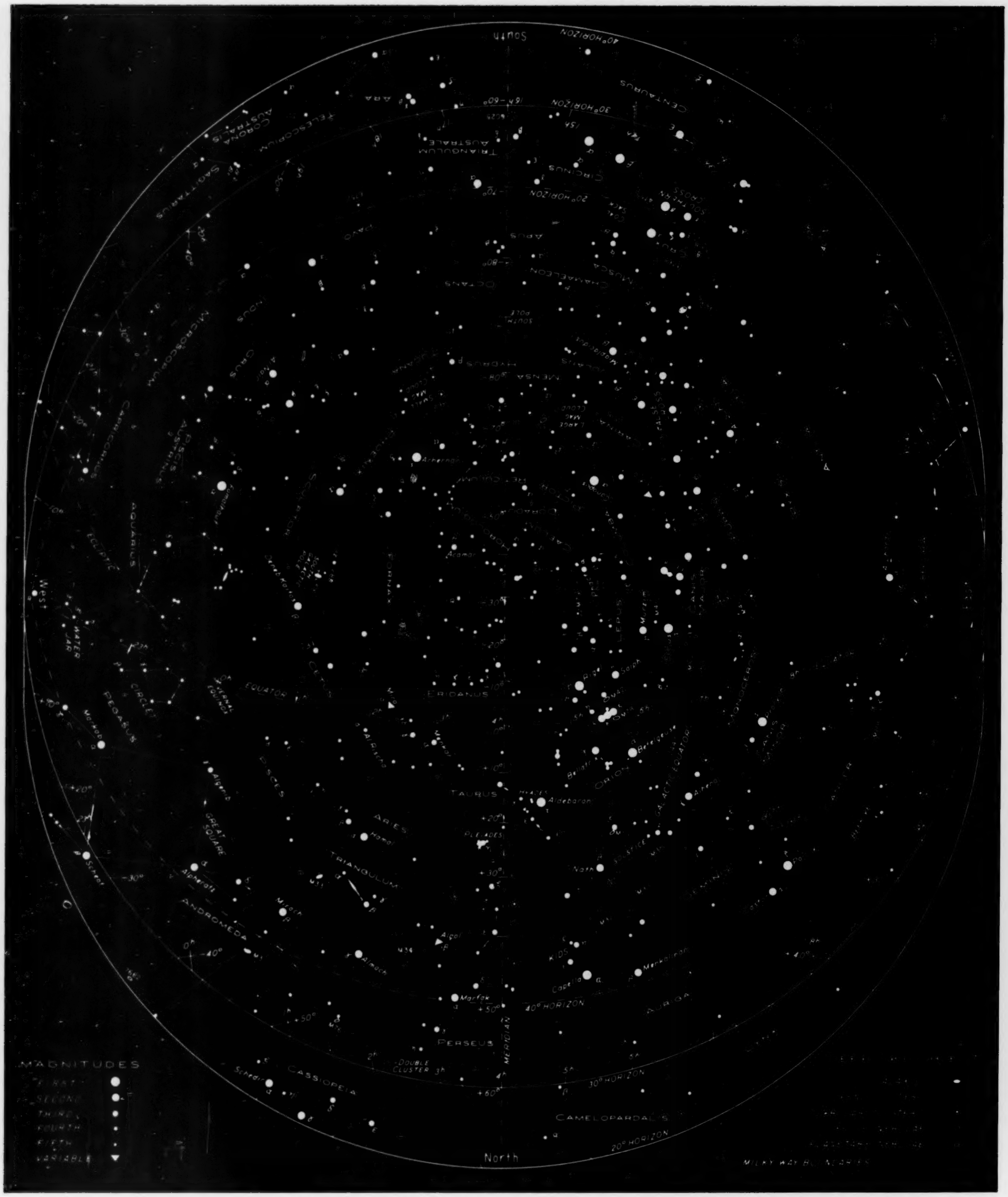
METEORS IN OCTOBER

The Orionid meteors, ranking third among the annual showers, may be observed this month. The maximum is about October 19-20, with a total duration of around 10 days. Orionids are usually swift. Twenty meteors per hour may be recorded after midnight with favorable conditions; however, this year the moon, although nearing last quarter, will be traveling in Taurus and Gemini during the shower. The radiant is about 10° northeast of Betelgeuse (6^h 24^m, +15°).

Following the Orionids, the Taurid meteors commence, a less dense swarm than the former. Maximum rates of about six per hour come the first 10 days of November.

E. O.





The sky as seen from latitudes 20° to 40° south, at 9 p.m. and 8 p.m., local time, on the 7th and 23rd of January, respectively.

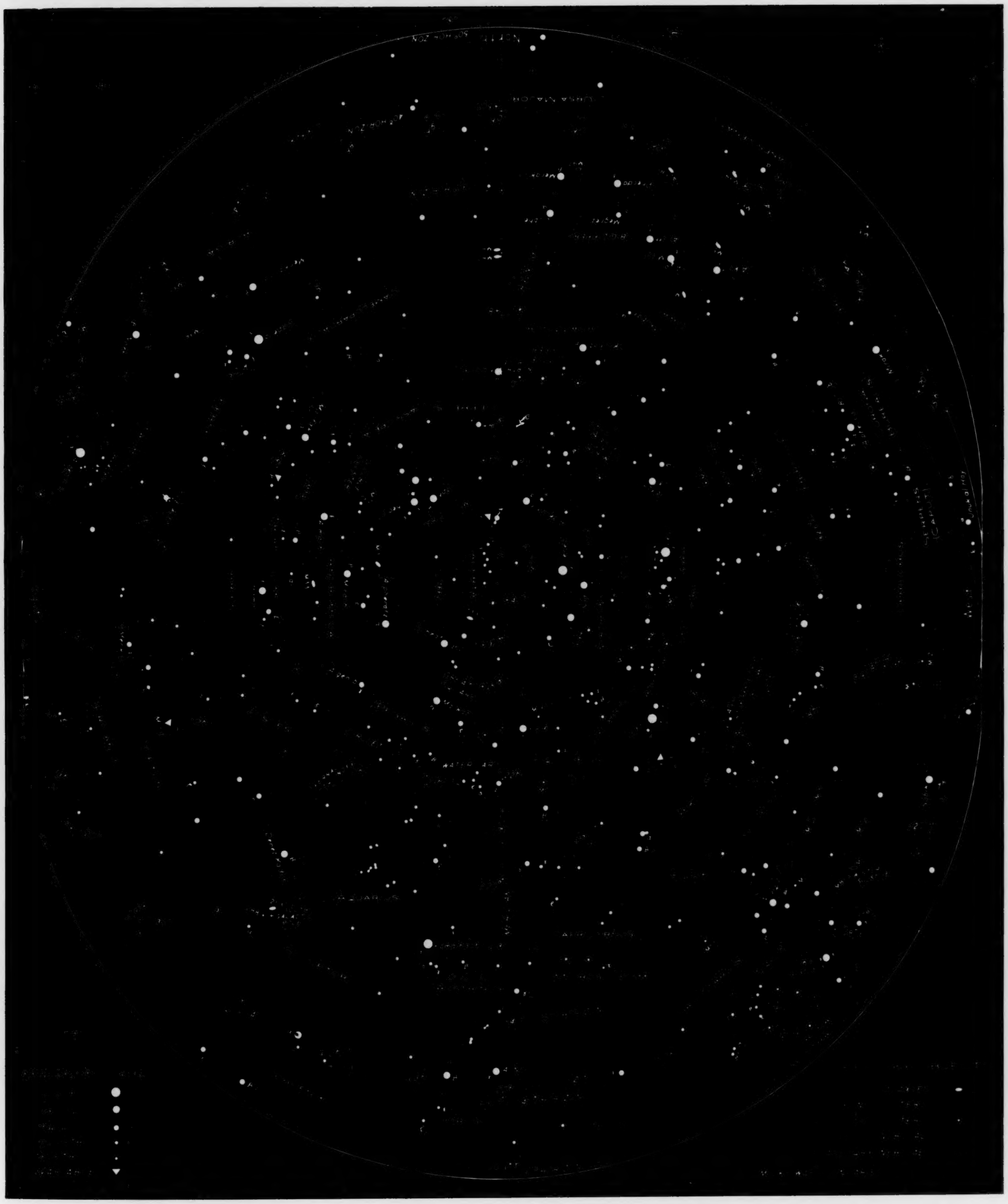
SOUTHERN STARS

TWO PATCHES of stars, apparently cast adrift from the Milky Way, capture the attention of observers on summer nights in the Southern Hemisphere. But appearances are misleading, for these patches, the Magellanic Clouds, are in reality far distant from the nearby portions of the Milky Way. Most recent estimates, made possible by photoelectric measurements of star magnitudes in the Small Magellanic Cloud, place them about 78,000 light-years from us.

Associated with the Large Cloud is 30 Doradus, sometimes called the Tarantula nebula, a large, complex diffuse object visible to the naked eye. If 30 Doradus were as near to us as the Orion nebula, its brilliance would cast shadows on the earth.

In Tucana, near the Small Magellanic Cloud, are two globular clusters worthy of note: NGC 362, of the 8th magnitude, and 47 Tucanae, NGC 104, of magnitude 4.5.

Canopus, a star 1,900 times as luminous as the sun, is high in the January sky, as are also Achernar, Sirius, and Rigel. Low in the north is Capella. Observers as far south as Buenos Aires and Montevideo may see Capella for a few hours in the evening as the year begins.



The sky as seen from latitudes 30° to 50° north, at 9 p.m. and 8 p.m., local time, on the 7th and 23rd of October, respectively.

STARS FOR OCTOBER

A PERHAPS apochryphal tale relates that Hevelius designated a group of stars near Cygnus as Lacerta, the Lizard, because no other animal could fit such an odd space. Actually, this spot in the Milky Way, left vacant by the ancients, was the subject of several modern naming attempts. In 1787, Bode christened the area Frederici Honores, for Frederick the Great, but like an attempt a century earlier by Royer to call it the Sceptre and Hand of Justice, in honor of Louis XIV, the name dropped into obscurity.

In Lacerta, which is near the meridian on this month's chart, Hevelius listed only 10 stars, and it is this number that are brighter than magnitude 5.0. The brightest star is of magnitude 3.85, the second brightest is 4.22, and the others fainter than 4.5. Nevertheless, Lacerta may be picked out easily, looking in part like a miniature Cassiopeia, shaped like a W.

This small constellation is famous for having had two bright novae appear within its boundaries, one of the 5th magnitude in 1910, the other of the 2nd magnitude in 1936. It also contains a number of well-known variables, of which the following are regularly on the AAVSO observing lists: RS, RY, S, R, RV. There are 134 variables in Lacerta.